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AUTHOR Rexroat, Melvin E.
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ABSTRACT

This first module in the "Mathematics Methods and Materials" cluster for preservice elementary teachers is designed to help the intern teacher consider different ways of teaching and of learning mathematics. The rationale for the module is provided, followed by lists of objectives, instructional activities for the intern to complete, and assessment procedures to be followed. Eight reading handouts, each concerned with different aspects of changing standard classroom educational procedures are included in the module. (DT)

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CMM:006:01 (ISU)

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ORIENTATION TO MATH METHODS AND MATERIALS

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Rationale:

These Modules will likely require that an Intern CHANGE many of his/her views of how math is taught and learned. Many ideas and processes will necessitate a willingness to explore; to experiment; to be more open to experiences which are different, strange, or even controversial. This Orientation Module is designed to help the Intern develop a "learner set" toward CHANGE. Thus, the Objectives of this Module are EXPRESSIVE, that is, they emphasize experiences which hopefully will contribute to the Intern's appreciation of the above concepts with no intent to measure any specific competencies or outcomes that should be demonstrated.

Pre-requisite

None

Pre-Assessment

None. Since the Objectives are EXPRESSIVE, the Intern is asked to complete them and report them. Little or no Team Leader involvement will be necessary.

Objectives (Expressive)

To complete this Module, the Intern will:

1. Read the handouts and make the responses to material as noted in the Instructional Activities.

2. Complete the surveys, activities, and observations outlined in the Instructional Activities.

Instructional Activities

NOTE: Since the Objectives for this Module are expressive, the Intern is asked to complete all of the following Instructional Activities.

1. Read the following handouts:

   a. Clark: "Wanted: Classroom Teachers to Do Research on Basic Practices of Elementary School Mathematics."

   b. Kohl: "A School Within a School."

   c. Kohl: "Excuses, Excuses--Change!"

   d. Heddens: "Changes Taking Place in Elementary School Math."

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Instructional Activities (continued).....

1. e. "Facilitating Inquiry in the Classroom."

   f. Jackson: "The Student's World."

   g. Gattegno: "The Powers of Children."

   h. Allender: "New Conceptions of the Role of the Teacher."

   (NOTE: Report completion of your reading on the Module Record Form and have the Team Leader verify completions.)

2. Refer to the handout, "Motivation and Learning" and follow the directions written on that sheet. You will note that it asks you to mark your responses individually, discuss them with another Intern or Team Leader, then individually write your reasons for choosing your responses and re-write any statement that you disagree with. Two copies of the handout are provided and you are encouraged to date one of them that you are completing during this Module and to re-mark the second sometime later without referring back to the first one; then compare your "changes" or "shifts." (These need not be sent to the TC Office, but the Team Leader is asked to verify on your Module Record Form that you have marked this at least once.)

3. Select points of view from at least two of the handouts listed in Instructional Activity #1 and WRITE a brief "reaction" which you have to these views. Emphasize in your statements what implications these seem to have for you and for learners you are working with. (NOTE: Attach this brief reaction paper to your Module Record Form when you have completed this Module. Your Team Leader should share your paper before it is sent in.)

4. Share one of the handouts with a Cooperating Teacher, seek her cooperation in reading it and later discussing it with you as to his/her reactions and the implications it seems to hold. Report your experience to the Team Leader to verify completion on the Module Record Form. (No report needs to be sent to the TC Office.)

Post-Assessment

Completion of the Instructional Activities will constitute the Post-Assessment since the Objectives of this Module are EXPRESSIVE. The Team Leader will initial the Module Record Form to verify completion. You are asked to submit to the TC Office a brief written statement as a part of Activity #3.

Remediation

None needed if Instructional Activities are completed.

MODULE RECORD FORM

Intern_____

Module No._____Title:_____

Date Started:_____

Date Completed:_____

Record of Team Leader Conferences: (Team Leader please initial)

Dates	TL Initials

Record of Instructor Seminars: (Instructor please initial)

Dates	Inst. Initials

Written materials completed. (Please attach Pre- and Post-Assessments and written records on Instructional Activities.)

Send this form and attached materials to the Teacher Corps Office.

For TC Office use ONLY:

Included in _____course credit.

Date Module Satisfied_____Approval_____

REMARKS:

MODULE FIELD-TEST EVALUATION FORM

INTERN

MODULE #_____ TITLE_____

COURSE #_____ MODULE BEING STUDIED BY_____
(INTERN)

---

1. INDICATE WHICH CATEGORY YOU BELIEVE BEST DESCRIBES YOUR EVALUATION OF THIS MODULE: (CHECK ONE)

____A. KEEP-AS-IS
____B. DELETE ENTIRELY
____C, MODIFY BY DELETING PORTIONS (UNDER #2 IDENTIFY WHICH PORTIONS SHOULD BE DELETED.)
____D. MODIFY BY ADDING PORTIONS (UNDER #2 IDENTIFY WHICH PORTIONS SHOULD BE ADDED.)
____E. MODIFY BY RE-WRITING OR RE-DESIGNING PORTIONS (UNDER #3 IDENTIFY THE KINDS OF RE-WRITE OR RE-DESIGNING YOU VIEW NEEDED--BE SPECIFIC.)
____F. OTHER (SPECIFY UNDER #2).

2. SUGGESTIONS FOR MODIFICATIONS OF MODULES: (FROM #1--C, D, E, OR F ABOVE).

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3. HOW DOES THIS MODULE SATISFY THE FOUR CRITERIA FOR A MODULE LISTED BELOW? (YOUR COMMENTS ARE WELCOMED).

	NOT AT ALL	LITTLE	SOME	VERY WELL
A. "FIELD-ORIENTED"--(UTILIZES KNOWLEDGES AND SKILLS IN APPLICATIONS WITH LEARNERS IN THEIR USUAL LEARNING ENVIRONMENTS IN THE SCHOOL AND COMMUNITY):	_____	_____	____	_____
COMMENTS:				
B. "COMPETENCY-BASED"--(REQUIRE DEMONSTRATION BY INTERN OF CRITERION-REFERENCED COMPETENCIES IN KNOWLEDGES, PERFORMANCES, SKILLS, ATTITUDES, ETC.)	_____	_____	____	_____
COMMENTS:				

MODULE FIELD-TEST EVALUATION FORM

INTERN

	NOT AT ALL	LITTLE	SOME	VERY WELL
C. "PERSONALIZING"--(ALLOWS INTERN TO CHOOSE FROM AMONG ALTERNATIVE INSTRUCTIONAL ACTIVITIES INCLUDING DESIGNING HIS/HER OWN, RELATED TO THE OBJECTIVES OR COMPETENCIES OF THE MODULE):	_____	_____	_____	_____
COMMENTS				
D. "EMPHASIZE SATISFACTION OF PRODUCT OR CONSEQUENCE OBJECTIVES"--(EMPHASIS UPON LEARNER PERFORMANCE OUTCOMES--WHAT CHANGES TAKE PLACE IN CHILDREN AS A CONSEQUENCE OF THE INTERN'S INSTRUCTIONAL EFFORTS):	_____	_____	_____	_____
COMMENTS				

TC OFFICE

MAIL OR SEND TO TC OFFICE I.S.U., POCATELLO

DATE EVALUATED: _____

EVALUATORS NAME _____

CHECK ONE:

INTERN _____
TEAM LEADER _____
COOPERATING TEACHER _____
INSERVICE TEACHER _____
OTHER _____ (IDENTIFY)

WANTED: CLASSROOM TEACHERS TO DO RESEARCH ON BASIC PRACTICES OF ELEMENTARY SCHOOL MATHEMATICS

H. Clifford Clark*

Many ideas concerning the teaching of elementary school mathematics are accepted as axioms. Few have been adequately tested. Too often, the basic assumptions for the teaching of mathematics are developed as a result of the intuitive hunches of curriculum innovators or textbook writers rather than upon field-tested studies.

In the recent past thousands of elementary teachers have modified their instructional methods in an attempt to keep pace with current trends. Methodology now places a greater emphasis on understanding the mathematical processes of arithmetic. Scores of new teaching models, manipulative materials, and supplementary aids have found their way into the classroom.

In a period of such activity it is appropriate to examine carefully many of these teaching practices and materials. Intuitive hunches regarding instructional procedures need to be replaced by field-tested research activities and studies.

A major burden of this applied research responsibility rightfully falls to the classroom teacher. No other person is in a position to fulfill this role. Hundreds of elementary classroom teachers are needed to engage in creative research activities to test the validity of recent notions that are accepted practice in teaching elementary school mathematics.

In the past the typical role of an elementary teacher, with regard to research, has been somewhat dull, routine, and passive. For the most part he was never consulted during the conceptualization stage. He has primarily been asked to answer questionnaires; carry out prescribed treatments; administer tests; or perform other, similar, though predetermined, routine tasks. His creative role in designing relevant research has been limited. Few elementary teachers have actually been encouraged to design and execute a researchable idea in their classrooms. In short, the teacher has not been an accepted partner in the research enterprise.

The word "research" has often frightened elementary teachers. Sophisticated researchers have emphasized the need for precision in sampling theory and research design. Complicated statistical procedures have made many elementary teachers feel inadequate and incapable of conducting useful research in their classrooms. Nonparametric measures are viewed with disdain. As a consequence, little applied research is accomplished and many ideas, useful and otherwise, in teaching elementary school mathematics go unchallenged for want of someone to bring them under scrutiny.

While basic research certainly has a place in elementary school classrooms, teachers should be actively engaged in many applied research activities as a natural consequence of their desire to improve instruction. A creative problem-solving approach involving informal activities is often helpful in building a foundation for more formal research. Suppose, for example, that as a fifth-grade teacher you devise an alternate approach to teaching the division of common fractions. You may then develop a set of trial exercises and, if well satisfied with their effectiveness, submit them to a more rigorous examination.

The classroom teacher must continue to provide the laboratory for formal research initiated by the local district or an outside educational agency. Still, confident teachers should play a more active and direct role in determining priorities for effec-

Wanted: Classroom Teachers To Do Research
On Basic Practices Of Elementary School Mathematics

H. Clifford Clark*

tive instruction in mathematics.

There is yet another manner in which teachers may play a significant research role from their classroom positions. In many cases original research is limited to small samples from isolated areas. Therefore, questions arise as to the generalizability of these studies to other classrooms or school districts. There is a critical need for many studies to be replicated under varied circumstances to establish a broader applicability. With some ingenuity teachers can contribute much by repeating selected procedures with students, keeping a record of the results, and comparing the findings with those reported earlier. When a teacher finds a difference in results between his class and those reported in the literature a more extensive and carefully controlled study might ensue in order to verify the findings.

It was stated earlier that a carerul examination is needed of many current teaching practices and materials which have been introduced in elementary school mathematics. Specifically, what are some key practices and basic assumptions common to contemporary programs that might be questioned through classroom research?

To answer this question an examination of professional textbooks, periodicals, and other writings relative to mathematics education was made. A large list of statements was compiled, condensed, and carefully edited. From the many assumptions generated, four have been selected for illustrative purposes. Each of the four appears below, together with one suggestion for a classroom research activity. Some of the assumptions are based on considerable research, while others are more indefinite. Each appeared repeatedly in the literature. Teachers can scrutinize these statements carefully, test them in the manner suggested, and consider additional ways in which these and other assumptions that can be devised might be tested.

Assumption no. 1 If an increased emphasis is placed on providing children with meaningful experiences in arithmetic, there is less need for separate practice of the drill type.

Activity no. 1 Select a topic to be introduced for systematic study in the third-grade class; for example, regrouping in subtraction. Design learning activities to occupy four class periods. Spend the same amount of time on arithmetic as normal. However, spend an incresed amount of time witnin the period developing appropriate illustrations with pupils, manipulating relevant materials, and exploring alternate solutions. Spend a decreased amount of time on drill activities. At the end of the four class periods give the children the test usually employed for this topic. The assumption is made that the test contains exercises normally used for drill purposes. Compare what the children achieve with what they normally accomplish on similar topics. A further comparison of the achievement with the previous group of children who took the test may be made.

Assumption no. 2 Rules and relations in mathematics which are discovered by learners are retained longer and are related more readily to similar concepts.

Activity no. 2 Will first graders who learn their basic addition facts through a discovery approach retain them longer than those who learned them only by rote-learning methods?

Wanted: Classroom Teachers To Do Research
On Basic Practices Of Elementary School Mathematics.

H. Clifford Clark*

Two first-grade teachers might cooperate to explore this question. Instructor A teaches a given set of basic addition facts using only rote-learning methods. Immediately following the instruction the students are tested. No further instruction on these facts is given for two weeks, at which time a retest is given to determine retention.

Instructor B teaches the same set of basic addition facts using a discovery approach which provides opportunity for the students to generalize and discover the for themselves. Following the instruction the same testing procedures used by Teacher A are followed by B. A comparison of the results for each group is made to determine which method has the better retention power.

Assumption no. 3 Elementary school children are capable of learning more mathematics than has been taught in the past, and can understand subtle mathematical concepts previously thought too difficult to be learned in the elementary school.

Activity no. 3 To test this assumption encourage the students to gain a deeper understanding of some specific mathematical topic. This may require some additional learning on the teacher's part. One such topic might be the coordinate plane. Become familiar with the process of using ordered pairs to name points on the coordinate plane. Develop some lessons designed to teach this skill to the pupils. When the teacher feels the pupils have been adequately taught how to use ordered pairs to name points, and how to write an ordered pair which corresponds to a given point, he gives them a test that:

(1.) contains a coordinate plane;
(2.) provides ordered pairs which the pupils are to locate and connect with line segments;
(3.) requires them to name, when appropriate, the geometric figure they have constructed.

Now the test results are analyzed to determine the extent to which pupils were capable of learning this concept. If students did well, there is less reason to question the validity of the assumption stated above. If the students did poorly, additional research might be undertaken to test this assumption further.

Assumption no. 4 Improved techniques of teaching, and the use of supplementary aids, can make it possible for pupils to learn more in less time.

Activity no. 4 Contemporary math programs have focused a great deal of attention on specific new techniques for teaching certain mathematical concepts. A third- grade teacher might develop a specific procedure using array cards to teach his class beginning concepts of multiplication and division. An accurate record of the time spent is kept and compared to previous methods to determine if this newer technique can be taught as effectively in less time. The same procedure might be used to test any number of supplementary aids and manipulative materials. A more extensive and carefully controlled study might follow to verify the findings.

* From Math is a Verb, Schminke & Arnold, Dryden Press, 1971.

You have found other teachers interested in effecting change in your school's approach to education. What next? Here are some suggestions . . . and some cautions.

When I was teaching in the New York public schools there was always talk about innovation and change. I taught in both a Higher Horizons Schools and a Special Services School, while some of my friends worked in a More Effective School. We were all supposedly involved in education innovation. Our schools, however, really didn't differ much from each other or from the supposedly non-innovative schools.

We still had to follow a set curriculum, the students had to perform or be punished, and the supervisors spent most of their time handling discipline problems and making sure there was no unfavorable publicity for the school. The "innovations" we were part of consisted primarily of receiving prettier and slicker textbooks, having smaller classes for a few hours a day while we smoked in the teachers' lounge. Admittedly some of these changes made our lives as teachers easier (and all of them, of course, cost the school system a lot of money). However, they had nothing to do with teaching, learning or the lives of the students.

These innovations had another self-defeating characteristic. They came from above--from experts at some university, or from the union's central office or the curriculum division of the board of education. They were filtered down to us teachers through the principal, who was sent a series of "guidelines for innovation." None of us was consulted on how a specific change would fit in with our school, the needs of our kids or with ideas we valued. We were treated like soldiers who must obey orders from above, however questionable their value. Innovations were pasted onto our ongoing programs and soon melted into the regular program. These innovations designed for all schools fit none, and therefore had little effect.

New Structure

I don't believe innovations commanded by experts from above and imposed upon teachers will produce significant change within the existing schools. I'm especially doubtful about this if the innovations merely introduce quantitative changes without creating new structures. It is the spatial, temporal and personal life that is lived within the schools that needs to change.

Fundamental changes must arise out of the specific needs and problems of individual students and teachers. They cannot be packaged. Let me give a few examples of specific qualitative changes that can open things up and lead to the development of open mini-schools:

1. Spatial restructuring can take place by eliminating fixed and assigned seating in the classroom. On the first day of school let the students sit where they choose and let them change seats at will throughout the year. Disputes about seating can be dealt with as practical problems to be solved by the per sons involved rather than as discipline problems requiring punishment.

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*From: Grade Teacher, October 1969, pp. 11-14; by Herbert Kohl.

2. Temporal change can take place by abandoning the notion of spending fixed periods of time on individual subjects. Reading can go as long as people are interested in it; math can be forgotten for a few weeks and then returned to; history can take up a few weeks to the exclusion of other subjects and then be dropped for a while. More readically, punctuality could be given up as a moral concept. Students could come to school between 8 and 10 and leave any time from 2 to 4. If school is interesting, students will stay. If not, they ought no be confined.

3. You, the teacher, can give up the power to punish or grade students, can give up lecturing all the time, and instead spend time discovering interesting things to add to the classroom environment.

While these three types of innovation cost nothing financially, they do require a great deal of your time, work and patience be fore they begin to work well. Once they take root, however, life in school just might be more fun and richer for everyone concerned.

From the Ground Up

An open school within an existing school probably has the best chance of succeeding if it starts from the ground up, from the teacher and the students who must live with it, andtherefore it cannot be imposed from above. You cannot tell people, "Be open," and expect anything but a mockery of a free situation to develop.

Teachers and students who are interested in opening things up must start by considering how they can do it in their school with the specific cinditions they face. For example: How many students are willing to try something new? How many supportive parents are around? How much support can be expected from the administrations? From other teachers?

There are other specific questions to be considered: What part of the school is most isolated and will provide the mini-school with the provacy it might need? How much cooperation will be gotten from janitors, school secretaries, parent aides, special teachers? You must estimate the strangths and weaknesses of your specific situation.

In some schools it is easiest to develop an experimental program with "special" students whom the school has given up on. In other cases, all students are so ready for change that you would hardly know where to begin. You must spend time assessing the specific nature of your school in order to develop a strategy for change. It is not enough to have good ideas or good intentions.

An Element of Risk :

I want to add a cuationary note: Too many good-willed attempts to change public schools are destroyed because the teachers and students involved believe that the rightness and humanness of their ideas is sufficient to eliminate oposition and open things up. It doesn't work out that way. People in power do not like to give up their power even though their positions may be intellectual and humanly untenable.

There are several general strategies that I would like to end with. They have been evolved by a number of people who have gone through the agonies of trying to restructure their public schools:

1. At the beginning, it is usually unwise to cut off completely people who claim to be interested in innovation, and yet are not trusted or are not personal friends of members of the core group.

2. All reasonable objections to your plans must be met reasonably and patiently.

3. Plans ought to be kept out in the open.

4. The project needs to be open to intelligent evaluation.

5. If all these conditions are met and there is still serious opposition to change, you ought to be willing to go ahead anyway, even if it means taking risks.

Teachers give many excuses for resisting change in their classrooms. But in all too many cases they're just not good enough. For the past few years I have been writing these columns to encourage teachers to open things up in their schools, to make their classrooms livable, to create choeces for their students. Some of my readers have been overtly hostile and closed to the kinds of change I've suggested. Others have been excited and enthusiastic about trying new things. Some have been making changes for years and have found support in the recent writing on the subject.

The great majority of teachers I have spoken with, however, are interested in the idea of openness byt are still unwilling to try it in their own classrooms. These teachers acknowledge that school is frequently irrelevant and often oppressive for student and teacher alike. Yet they claim that change must be sanctioned from above or supported outside of the public schools. In this column I want to examine some of the excuses teachers have given to justify not changing.

The excuses I have heard nost frequently fall under five general headings. Teachers say:

1. I can't change because my principal won't let me. Variations on this theme are: The other teachers won't like what I'm doing; the janitor thinks my classroom is too messy; the school secretaries object to the noise in my room.
2. I can't change because I'm afraid. This general expression of fear has many manifestations and is perhaps the most common excuse given. Some teachers are afraid that they won't know what to do in an open situation where they give up their absolute power. Others are afraid that they'll lose their jobs or be forced to confront their supervisors. Some teachers are afraid that their students might go wild and hurt them if controls were removed, or that the students might say unpleasant truths about them.
3. I can't change because the parents won't understand. Teachers are afraid that they will get static from the parents of their students, that the parents will want to defend a rigidly structured form of learning and that they won't understand the values of an open classroom.
4. I can't change because open learning will harm my students in their future schooling because the next year they will have to return to the old rigid system. A variation on this argument goes that students in open classrooms might be happier but they won't be prepared to get into college and that is an unfair disadvantage for the student.
5. I can't change because the time isn't ripe, because the political climate in my community opposes change.

POSITIVE PHENOMENON

The five categories of excuses overlap considerably, and the fear of change is present in all of them. The fact that so many teachers feel compelled to make excuses is a positive phenomenon, for it means that they perceive the need to change even it their role in creating change isn't clear. I will examine the five categories and suggest ways in which teachers can move from excuses to actions.

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*From: Grade Teacher, September 1970, pp. 16-22; by Herbert Kohl.

My principal won't let me change: Independent adults don't need permission to change their personal ways of living. Teachers rarely feel or act independently insofar as their school lives are concerned. Only recently have the union and teachers associations begun to make demands in the name of teachers. Teachers usually follow directions, take what is given them and live lives of quiet frustration in their classrooms.

I know a teacher who tried to open up her room by moving the chairs around and letting the students sit where they wanted. The janitor in the school complained to the principal that her new arrangement made his job of cleaning the room more difficult, and the principal ordered the teacherto put the desks back in rows and columns for the convenience of the janitor.

The teacher complied and complained to me that she wanted badly to open up her room but the principal wouldn't let her. I asked her why she didn't fight his decision. After all, the principal knew as well as she did that schoold do not exist to make janitor's jobs easier. She just shrugged. She didn't want trouble. Yet she had trouble anyhow. She lived with her frustration and it was communicated to her students. When I visisted the room I could sense defeat.

She could have fought reasonably and well over the placement of the tables and desks in her room. She could have continued her arrangement and straightened out the desks before the janitor arrived to clean. But she wasn't used to acting on her own, to taking initiative and defending what she believed was right. She was part of the silent majority of teachers who want to change but are so used to being dependent on the school system to make decisions for them that they don't know how to act independently.

Many changes can take place through the initiative of individual teachers. After all, how much does a supervisor know of what actually happens in the classroom? There are some innovations that can only be carried out with permission since they are so visible. Taking four trips a week, or extending the boundaries of one's classroom into the halls, or painting the walls of the schools are such public acts that they will attract immediate attention. But providing students with time to do what they care to, developing a series of activities that the students can choose to participate in, putting down rugs in corners of the classroom, seeing students before 9 and after 3 are much less conspicuous ways of beginning to open things up. No attempt to change is without risk, however. This leads to the second category or excuses.

I can't change because I'm afraid: Many teachers live with fears all their professional lives. The more rigid a classroom the more the teacher generally fears the students. When a great distance is maintained between teacher and students it is natural that mutual fears develop. The students and teachers are unknown to each other and the unknown is unpredictable and often threatening.

The fear of chnaging is similar to many teachers' fears of their students. Change is not controllable or predictable and though it is possible to provide teachers with hints on how to open up their classroom the main burden is on them.

I have found that the best way to proceed is to identify one specific thing that I am afraid to do with my students and yet think would make our lives together more comfortable. This may involve doing simple things like touching one's students or letting them call you by your first name. It might mean leaving the classroom unsupervised

for a few minutes every day and allowing the students to become able to get along with each other without the presence of an adult.

Fear of the loss of one's job is real, though less so if one has tenure. However, there are risks to be taken. I found myself in the position of having to decide whether I would maintain my job or my self-respect a number of times during my teaching career. And I have lost jobs. However, there are many things one can do to effect change that incolve smaller risks. Every individual must face the problem of the value and honesty of his or her life's work some time.

I can't change because the parents won't understand: Educating parents to accept change in the schools is not an easy matter. Parents do respond to teachers who know their children as individuals, and who express obvious concerns for their children's interests and future lives. My experience has been that it is always more convincing to parents if changes in their own children are used as illustrations of what open learning is all about rather than citations from books by experts or abstract discussions about freedom and authority.

There are some parents who will never be convinced that an open classroom makes sense for their children. They should be provided with the option of transferring their children to another calss in the school. Teacgers always trade off a number of students anyway, so why shouldn't this tradition be used to allow parents the choice of the classroom most suited to their and their children's needs.

During the first year of change it is difficult for teachers to convince parents of the value of their work because they are grouping themselves. It is much easier the second year. In fact, the greater confidence the teacher has in his work the easier it is to convince parents of the value of the work for their children.

I can't change because open learning will harm my students in their future schooling: I have not found this to be true. Students who function autonomously in open classrooms can, if they choose, adjust to many circumstances. They know what to expect from different teachers and can change their styles. Further, students themselves are increasingly taking the initiative in changing their schools to meet their needs and often it is next year's teacher who needs to worry about survival, not the students.

I can't change because the time isn't ripe: There isn't much I can say about this excuse. If the time isn't ripe to change now, then it might be in a few years, if there are any schools left. A friend of mine, Jim Herndon, once said at a teachers' meeting, "The only reason people don't change is because they don't want to." Jim did not mean that changing was an easy thing. It is difficult to face one's life and rethink it, to change comfortable or at least workable modes of behavior. Yet my feeling is that now for many of us we can do no less than rethink our lives and act for our own as well as our students' survival.

CHANGES TAKING PLACE IN ELEMENTARY SCHOOL MATHEMATICS*

During the past fifteen years the elementary school mathematics curriculum has undergone numerous changes. New mathematical topics have been introduced and traditional mathematical content has been reorganized. Inconsistencies in the presentation of mathematical content have been removed, partly through greater stress on precision of language. Most of the new programs emphasize an inductive, discovery-type approach rather than rote memorization. If we examine the nature of these changes, we may gain a clearer picture of what contemporary mathematics programs are like.

1. New topics have been introduced into the elementary school. The phrase "new topics" may be slightly misleading; the topics themselves are not new in mathematics, but they are comparatively new to the elementary curriculum. The concept of set, for example, was developed late in the nineteenth century; today the basic ideas of sets are being used to develop concepts of whole numbers. The idea of counting in bases other than base ten is an ancient one, but it was introduced into the elementary curriculum only about fifteen years ago. Informal development of geometric concepts is another area of major innovation. More recently the function concept, informal logic and geometric transformations have won places in elementary school mathematics.

2. Traditional mathematical content has been reorganized. Rather than introduce a variety of static and seemingly unrelated ideas, the goal of contemporary mathematics programs is to develop better pupil understanding of the relation between mathematical ideas and the part these ideas play in the unified structure of all mathematics. Thus the unifying concept of a set is used to describe fundamental ideas in arithmetic, algebra, geometry, and logic. In arithmetic we use unions of disjoint sets to develop the meaning of addition. Subtraction is discussed by using the idea of inverse operations. Later the operation of multiplication is seen to be related to the process of repeated addition, and division is developed as the inverse of multiplication. Gradually the pupil comes to understand that the four fundamental operations are closely related. He explores, finds patterns, and discovers properties--commutative properties, associative properties, distributive properties, and so on. This approach not only gives the pupil a basis for understanding why various computational procedures work, it also helps eliminate needless repetition. By teaching structure in conjunction with basic number facts, we prepare pupils to understand integers and rational numbers as logical extensions of the whole number system.

3. Inconsistencies have been removed from the teaching of mathematics. Ideas taught in the elementary school were often inconsistent with ideas presented later in secondary school. For example, when elementary school children first learned subtraction, they were told that 3 cannot be subtracted from 2. Later, when integers were studies, this idea had to be unlearned. Today, using a development based upon the structures of mathematics, the child learns rational numbers and integers as logical extensions of the whole number system.

*James W. Hedden: Today's Mathematics: A Guide to Concepts and Methods in Elementary School Math; 2nd Edition, 1971. S.R.A. Pp. 3-5.

The change from a traditional mathematics program to a contemporary program is a shift in emphasis. Traditional programs were devoted almost exclusively to arithmetic; contemporary programs have a much broader base that includes parts of algebra, geometry, and logic as well. Traditional programs were usually based on computational drill and memorization of facts and shortcuts. Contemporary programs stress understanding of basic mathematical structure and an understanding of the different number systems. Is this to say that students must no longer memorize number facts and practice to develop computational skills? Definitely not. The point is that memorization and drill must be accompanied by an understanding of why the number facts are true and why computational procedures work. Without this understanding, the pupil has little chance of progressing very far in mathematics or applying the mathematics he knows to significant practical problems.

What are the aims of a contemporary mathematics program? In broadest terms, the mathematics program today has the same aims as any mathematics program of the past.

1. To equip the child with the mathematical skills necessary for daily life in our society.
2. To provide a satisfactory foundation for advanced study of mathematics. Such study is a necessity for anyone preparing for a career in a field involving mathematics: science, engineering, medicine, teaching, technology, and so on.
3. To provide some cultural background--an acquaintance with the history of mathematics and with the famous mathematicians and their discoveries.

Society is in constant change, and the elementary program must keep pace with the changing society. For too many years the elementary mathematics program was static. The introduction of "modern mathematics" during the sixties was an attempt to incorporate new content and learning research into school mathematics programs.

Our contemporary world demands a kind of mathematical knowledge that is very different from that required in the past. With previous generations the need was for people who could calculate efficiently and accurately. But now the task of calculation is being taken over by the machine. The machine is replacing the clerk and the computer is displacing an untold number of men. Today, and even more in the future, the need is for people who can, through disciplined imagination, define significant problems and discover ways to solve them.

Man is still the key. Machines are capable of fantastic computations, but constructing computer programs, programming them, and interpreting the vast amounts of data they produce are tasks for well-trained, analytical minds. The calculating capacity of computers has released man from the necessity for time-consuming computation and afforded him the time for creative thinking--for discovering and expressing the complex problems to be solved by machines. This necessity for abstract thought demands critical and analytical ability--and creative imagination--to discover new questions.

If elementary mathematics instruction is to develop creative and imaginative mathematical minds, it must overhaul its traditional methods of presentation and instruction. For generations the technique of instruction in traditional mathematics was a two-part process:

1. The teacher used examples to show how to solve a particular kind of problem.

2. Students routinely imitated this procedure to find answers to a great number of similar examples.

It is easy for this method of instruction to dengenerate into a mindless application of the deductive method. When this happens, mathematics becomes nothing more than imitation and drill. The method of instruction by repeated drill reveals little or nothing of the meaning behind the process the student is imitating. How many thousands of people work problems daily in which they "borrow" and "carry" numbers, wonder what to do with the "remainders," or try to remember which of two fractions is the right one to "invert and multiply"? Such confusion is the natural outcome of learning mathematics by imitation and memorization.

Rather than such a passive method of mathematics instruction, a contemporary program promotes an active learning process. In this active, or guided discovery, approach, a skilled teacher leads children through a careful step-by-step development to reveal the reasoning underlying mathematical techniques and processes. The pupil who recreates mathematical processes in this way gains more confidence through his own discoveries than by trying to recall memorized rules. He comprehends the reasoning behind mathematical processes and can recall and apply the processes in new situations better than one who has mechanically used a deductive procedure to solve stereotyped exercises.

The guided discovery approach relies on the inductive method of teaching. Children work a number of problems, using different methods to find solutions. After a number of examples, they may be able to formulate a generalized statement for solving problems of a particular kind. In effect, they find their own "rules" or generalizations, which they can then apply to future work.

Seen in this light, problem solving is an important feature of modern mathematics. Indeed, any successful mathematics program seeks to maintain a balance between abstract mathematics (generalizations) and problem solving. But problem solving (including the computation involved) is not performed merely for the sake of drill, and certainly not just to find the right answer. Rather it is a healthy and important part of the learning process.

Problem-solving activities should be varied in nature so that students do not get the idea that mathematical problems exist only in textbooks. Research in learning theory suggest that frequent use of physical objects which children can manipulate and experiment with is essential to developing abstract concepts. It is likewise an important part of developing skill in solving practical mathematical problems. Thus it is no surprise that there is increasing interest in laboratory activities for the mathematics classroom.

Laboratory activities can be used for a variety of purposes--to build readiness for abstract concepts, to provide motivation, to develop problem-solving skills, and to present significant applications of mathematics to practical problems. Children of all levels of ability can profit from laboratory experiences, and a folder of activities can be a valuable resource for the classroom teacher.

One great advantage of the inductive method is the freedom children experience in looking for ways to solve problems. Without set rules to condition their thinking, children are free to find that a given problem can be solved in various ways. Thus pupils discover through their own experience one of the major features of modern mathematics: there is more than one way to arrive at a solution to a problem. When children are allowed this freedom, and encouraged to use their imagination without being tied to arbitrary rules and rigid patterns, they will learn to seek the best way to solve any problem. Even slow students, guided by a careful and patient teacher, can appreciate the fact that a problem doesn't necessarily have just one way of being solved. This may, in fact, be a great encouragement to the slower, less imaginative student, who no longer must be baffled and discouraged by trying to remember half-understood rules.

In most cases a child's approach will be conditioned by his own experience. He may not choose the best or quickest way to solve a problem if his experience has not included relevant knowledge. For example, if a child who does not understand place value is called on to complete an addition sentence such as $23 + 41 = \square$, his best approach would probably be to use counters: count out 23, count out 41, then scoop the two groups up together and count to determine that he has a total of 64 counters. Another child might recognize that he has 23 counters and, beginning with 23, count out 41 more counters to arrive at 64. The second method is slightly more sophisticated than the first. A third child might recognize 23 on the number line and begin counting from that point. Beginning at 23, he would count 41 units and arrive at the point 64. Another child, familiar with place value, might react in this fashion: "Add the tens, $40 + 20 = 60$; add the ones, $1 + 3 = 4$; $60 + 4 = 64$; therefore my answer is 64." Still another child might arrange the addends vertically. He might thing "$3 + 1 = 4$" and write down the 4; "$20 + 40 = 60$" and write down 60 under the 4; and "$4 + 60 = 64$" and write down 64 for the answer.

$$\begin{array}{r} 23 \\ +41 \\ \hline 4 \\ +60 \\ \hline 64 \end{array}$$

Here are five different methods for completing the addition sentence $23 + 41 = \square$. In each case the child has had the opportunity to think according to his own level of ability. In this example each student has employed the same basic concepts, but at different levels of comprehension. The purpose certainly is not to keep children operating at a primitive level, but to move then as quickly as possible through appropriate experiences to more efficient levels of operation.

Children should not be allowed to get the idea that problem solving is simply a matter of thrashing about aimlessly until one happens to find a solution. An order-

ly and well-thought-out approach should be stressed. The approach used should be selected with reasoning and understanding. Children should realize, however, that even with careful selection one does not always choose the best method the first time, and they should be encouraged to make various approaches to a given problem when a solution is not readily apparent. Today teachers and pupils together may spend time seeking solutions to problems. Children should be aware that even capable scientists and mathematicians do not have a magical "instant" solution to every problem. It is good for children to know that mathematicians may solve problems, check them, and then go back and look for other approaches when their results indicate that something is wrong. The very nature of the word "problem" indicates that often a solution is not readily apparent.

FACILITATING INQUIRY IN THE CLASSROOM

CMM:006:01 (ISU)

Facilitating Inquiry in the Classroom IS:	Facilitating Inquiry in the Classroom IS NOT:
1. Allowing students to use and evaluate a rational process for building ideas and making judgments.	1. Another method for covering content.
2. Providing the means for students to gather the necessary information to build their ideas.	2. Conducting a question and answer game.
3. Establishing conditions which maximize decision making and decision assessment opportunities.	3. Everyone doing what he wants to do.
4. Allowing students to do for themselves.	4. Something the teacher does to students.
5. Allowing students to explore how explanations come to be "correct."	5. Leading students toward predetermined, "correct" explanations.
6. Allowing students to identify, try and evaluate their own strategies for solving problems.	6. Teaching students the steps for problem solving.
7. Allowing students to reach tentative conclusions based on current information.	7. Making sure that students leave the classroom with correct answers.
8. Exploring the meaning of truth with the students and allowing them to seek their own truth.	8. Disregard for truth.
9. Allowing students to develop personal meaning from accumulated knowledge and conventional practices.	9. Discounting or ignoring accumulated knowledge or conventional practices.
10. Interacting with students in any situation where student-initiated behavior is the goal.	10. Planning an activity that takes place once a week for an hour.
11. Using interaction skills gained through study, practice and use.	11. Just something that anyone can do.
12. Conceptualizing and considering the development of autonomous learners in a new way.	12. Something that we have always done in the classroom.
13. Interacting with students in a manner consistent with educational goals identified and valued by the teacher.	13. Ignoring other ways that students can and do learn.

ALLOWING INQUIRY TO HAPPEN

"What is Teacher Doing"

The studies of Anderson, Lippitt and White show rather conclusively that the behavior of the teacher sets the climate of the class.[1] Dick Suchman,[2] in his work at the University of Illinois, has identified the climate which maximizes the opportunity of individuals to inquire. He difines the climate by describing three CONDITIONS which the teacher must establish and maintain through his own behavior.

> FREEDOM: The more rules and restrictions thrown in the way of the child, the fewer choices he has and the less his activity resembles inquiry. But a permissive and relatively unstructured environment is not the total picture with respect to freedom....many children operating in such an environment are unable to accept and utilize the freedom. A truly free person has internal freedom as well as external freedom. He must be able and willing to accept and use the responsibility of making his own decisions. In short, a part of freedom is autonomy.
>
> Since autonomy is so much a part of personality, there is no simple way of maximizing autonomy for children. In the long run autonomy goes along with freedom. One learns to be autonomous by gradually making more and more autonomous choices, by being placed in situations where the teacher refuses to lead or program the children and. in a sense, forces them to take a greater part of the responsibility for their own learning. Once a child begins to sense that he has the capacity to grow conceptually under his own steam, he takes more and more of this responsibility.
>
> Much depends on the child's image of himself as a learner. As he comes to see himself as a person capable of gathering data for building and testing theories, he becomes more willing to engage in this activity and less concerned with looking foolish or failing to achieve according to some outside standard. Autonomy does accompany self-confidence, and self-confidence can only come by gaining experience in being autonomous.
>
> RESPONSIVENESS: A lone child in a completely bare room may have all the freedom he wants, but his capacity to inquire is tremendously restricted by the fact that he has no means of gathering data. Even if his ideas are rich and fluent, he is going to find it very difficult to engage in inquiry if he has no source of data to test ideas or to generate new ones. This is why a responsive environment is considered a crucial condition for inquiry. The inquirer must have a rich supply of data available when he wants them.
>
> Another very important aspect of responsiveness is the way the teacher responds to the child. Children who inquire freely and have access to a responsive statement are bound to come up with ideas of their own, formulations that represent the way the child sees and attempts to account

for the phenomena of his world. The formulation of such ideas is enormously important to the inquiry process and to the overall growth of the child. For this reason, it is essential that the teacher listen to the ideas of the child and make room for his expression. Unless the child externalizes these thoughts by bringing them out into the open to be looked at, the teacher may never be able to respond adequately to the child.

Inquiry thrives on the generation of theory but children will not pursue the generation of theory unless they feel that their formulations and thoughts will be received and considered.

FOCUS: Inquiry is most productive when it has direction and purpose. If all searching is diffused, there is never enough total mobilization of energy to penetrate a particular area of interest far enough to make a concerted gain in conceptual growth.

One way to provide a focus is to confront the child with an event that puzzles him. Such an event may be referred to as discrepant in the sense that it presents a phenomena that does not coincide with the child's knowledge and understanding of the world. A gap is created between what the child perceives and what he knows. The discrepant event provides not only a motivation to inquire, but also a focal point toward which the process of inquiry can be aimed.

Focusing, however, is not a one-shot activity. It is often necessary for a teacher to step into a situation in order to resharpen the focus of inquiry. Too often, children find satisfaction in a theory without really testing whether or not the theory matches reality. Nothing will get in the way of inquiry more than an oversimplified explanation that provides a feeling of closure. A teacher can effectively re-stimulate the process of inquiry by raising new questions that challenge the child's theory.

Focusing is not a matter of giving approval or disapproval, but a question of redirecting the child's attention to discrepancies and thus sharpening the focus for the child so that inquiry can continue productively rather than ending in a quagmire of unjustified closure. The teacher provides the child with the wherewithal to build and test theories.

The rejection of an idea that a child creates should be his own rejection. That is, if his idea does not stand up in the face of the data he has gathered, then he himself should reject the idea. If, however, he has no basis for rejecting the idea himself, he should not be told that the idea is wrong. In other words, the teacher will guide the child in the matching process, but the teacher will not do the matching for him.

Focus may take two directions. Initially and essentially, the focus of the inquirer is on resolution of the problem event or situation. Gradually, through teacher behavior, a second focus emerges--a focus on process. The teacher brings about a focus upon the processes on inquiry. A focus on process is a necessary condition to facilitate growth in the development of more productive, systematic

ways of confronting and dealing with future problem focus events. Gradually, through teacher's guidance and support, children become aware of what inquiry is. As a result of process focusing, they become increasingly able to confront and successfully deal with the fundamental question of inquiry, "How do you know if a theory is a useful one?"

Often, children do this intuitively, but they do not realize and are perhaps unable to verbalize the concept of what is deliberate action to this process.

The topic of this paper is concerned with classroom verbal interaction which allows and facilitates inquiry on the part of students. The question then arises, "What is it, specifically, that the teacher can do through his own verbal behavior to maintain the conditions of FREEDOM, FOCUS and RESPONSIVE ENVIRONMENT?"

The following pages are in answer to this question. You can learn the specific teacher interaction skills which allow students to inquire.

TEACHER TACTICAL MOVES ALLOWING INQUIRY TO HAPPEN

Suchman identified the general conditions essential to inquiry and the growth of inquirers. Strasser[3], building on Suchman's work, identified 22 categories of teacher verbal interaction, called TACTICAL MOVES, which the teacher uses to facilitate inquiry. Here, the 22 tactical moves have been reduced to 18 and reorganized to simplify learning and practice.

ALLOWING INQUIRY TO HAPPEN

1. Focus Setting
2. Structuring
3. Clarifying
4. Accepting
5. Responding to Data Probe
6. Teacher Silence

When learning and practicing these moves you are primarily concerned with establishing and maintaining the conditions for inquiry. Notice, your main intent is to define roles, facilitate communication and develop trust.

FACILITATING AUTONOMOUS STUDENT GROWTH

7. Identifying Inquiry Operations, Subjects of Operations
8. Identifying Inquiry Products: Data and Theory
9. Probe for Specificity
10. Teacher Probe for Data
11. Teacher Probe for Operations
12. Operation Clue Giving
13. Instructing

TUNING IN TO STUDENT FEELINGS, ATTITUDES, PERCEPTIONS

14. Probe for Theory, Status of a Theory, Inference
15. Probe for Intent of Operations, Intent of Subjects of Operations
16. Probe for Prediction, Explanation
17. Giving Data, Theories
18. Data Clue Giving

Teacher Tactical Moves
Allowing Inquiry to Happen

Here, the concern is with learning and practicing the moves which ALLOW INQUIRY TO HAPPEN. On the following pages each move is described four ways: Teacher INTENT, Teacher ACTION, Student ACTION and Student EFFECT. As you examine the moves, consider the four descriptions in the following manner:

Teacher INTENT;	An unobservable purpose you want to fulfill
Teacher ACTION:	Something observable you do to fulfill your intent
Student ACTION:	Something observable you expect the student to do in response to your action
Student EFFECT:	Some unobservable inner state of the student that you hope to be the result of your action

On each of the following pages, begin by reading the INTENT of the move in the first column. In some cases, a move will have more than one intent. Then become familiar with the teacher ACTIONS that are consistent with the identified intent. The teacher actions are those things the teacher says or does that are intended to bring about a desired response from students. The actions identified in the second column are those which have been found particularly useful to fulfill the stated intent. Refer then to the third and fourth columns which identify the anticipated and desired student responses. In this exercise it is important that you recognize the intent of each move and the actions which you can take to fulfill each intent.

INTENT Purpose teacher has in mind.	T. ACTION Observable teacher behavior to fulfill intent.	S. ACTION Anticipated, observable response by students to teacher's action.	EFFECT Anticipated inner state of student in response to teacher's action.
Intention I: Make a topic, legitimate for classroom or individual inquiry as identified by either teacher or student. Get students motivated to take action on their own.	1. Presents a problem event containing contrast or conflict. 2. Asks students to explain event. 3. Presents a problem event and allows students to identify problem. 4. Allows students to present problem event. 5. Accepts problem identified by student.	1. Asks questions about the problem. 2. Shares an idea about the problem. 3. States a problem after seeing an event. 4. Asks questions about problem he has identified. 5. Asks questions about his role.	1. Wants to become involved in problem. 2. Initially wonders "What's going on?"
Intention II: Have students consider and reflect on processes.	1. Asks questions about process elements: a. What is a theory? b. Where do theories come from? c. How do you get going if you don't have a theory? d. How does one come to know something?	1. Responds with his own perceptions of process. 2. Shares something about process from his own experience. 3. Makes a discrimination concerning process based on his own experience.	1. Feels the process is helpful to him. 2. Willing to discuss process. 3. Values the chance to talk about what he does.

INTENT	T. ACTION	S. ACTION	EFFECT
Purpose teacher has in mind.	Observable teacher behavior to fulfill intent.	Anticipated, observable responses by student's to teacher's action.	Anticipated inner state of student in response to teacher's action.
Intention I: Communicate a "different" kind of role for each, the teacher and students. Establish the ground rules under which the roles will operate.	1. Tells students they can identify their own problem for inquiry. 2. Tells students they program their own "problem answer"; the teacher doesn't do it for them. 3. Tells students he is there to listen to their ideas and will give his undivided attention while one is talking. 4. Tells students or lets them know how they can gather data through the teacher, books, other persons, etc. 5. Tells students he doesn't judge student's ideas; students judge their own ideas; he doesn't say "yes" or "no" when a student asks "Is my idea right?" or "Did it happen because.....?" 6. Tells students he gives data but not answers. 7. Tells students if they feel pressured to respond, they can ask the teacher to move away by saying "pass" or another signal. 8. Tells students if they want to consult with other students, they can call for a "conference." 9. Tells students he doesn't call on them unless they indicate they want to speak.	1. Students respond to the problem differently, some gathering data, others theorizing. 2. Identifies a problem not identified by the teacher or another student. 3. Lets the teacher know when he is through talking. 4. Gathers data through different operations. 5. Asks the teacher if his idea is right without knowing how to test the idea. 6. Shares an idea without asking the teacher if his idea is right. 7. Says "pass." 8. Test a theory. 9. Asks a series of questions related to one variable within the problem. 10. Asks for a conference. 11. Asks for a repeat of the problem event. 12. Shares a previous experience he has had. 13. Holds floor for long period of time. 14. Doesn't participate during a given experience.	1. Increased confidence about sharing his ideas. 2. More willing to risk a far out idea. 3. Enjoys "messing" with the problem. 4. Doubts he has as much freedom as the teacher suggests. 5. Wants closure and answer. 6. Feels good about being able to "control" the environment.

INTENT Purpose teacher has in mind.	T. ACTION Observable teacher behavior to fulfill intent.	S. ACTION Anticipated, observable response by the student to teacher's action.	EFFECT Anticipated inner state of student in response to teacher's action.
Intention I: Understand, in terms of the process, what the student is saying, how he isusing a word or concept and what he is trying to do.	1. Asks a student what he means when he uses a certain word. 2. Asks a student to repeat what he said. 3. Asks a student, "Are you saying..." and then paraphrases. 4. Asks a student, "Are you trying to get at data or are you sharing an Idea?" 5. Asks the student to illustrate on the chalk board. 6. Asks another student or allows a student to interpret. 7. Restates a student's question. 8. Asks the student to give an example. 9. Asks a student what he is going to do or is doing (process being used) when involved with equipment, books, pictures, etc.	1. Repeats what he has said. 2. Says, "No, that's not what I mean," or "Yes, that's what I mean." 3. Says, "No, that's not quite," and then adds more to his message. 4. Gives an example or analogy. 5. Uses the chalkboard to illustrate. 6. Continues to interact with the teacher after two or three probes at clarity by the teacher. 7. Tells if he is after data or sharing an idea. 8. Defines a word he has used and then uses the definition again in subsequent dialogue with teacher. 9. Sharpens a message to fine clarity after having had teacher seek clarity on previous occasions. 10. Over time, finds teacher having to ask less, "What do you mean?"	1. Trusts teacher. 2. Appreciates teacher's support. 3. Increasingly values his own ideas and his own ability to have ideas. 4. Values his own communication skills and wants to enhance them. 5. Values communication with teacher (and other students).

INTENT	T. ACTION	S. ACTION	EFFECT
Purpose teacher has in mind.	Observable teacher behavior to fulfill intent.	Anticipated, observable response by the student to teacher's action.	Anticipated inner state of student in response to teacher's action.
Intention I: Communicate that the student's ideas and thinking are valued by the teacher but are not judged by him; and that the expression of feelings is legitimate.	1. Says, "OK," or "I understand." 2. Says, "It's important to explore all your ideas." 3. Says, "It's important to want to know about that." 4. Says, "Well, it certainly could be," or "Well, it certainly might be." 5. Says, "Well, I guess things like that could make a difference." 6. Says, "I understand, you're saying....." (repeats or paraphrases what student has said). 7. Checks on perceptions he has about student's feelings. 8. Acknowledges feelings that student shares.	1. Shares an idea which is "far from convention or stereotype." 2. Says he doesn't like something or he thinks something is stupid. 3. Sticks with an idea even if some other students laught at it. 4. Says when he thinks he has received bad data from the teacher. 5 Asks to be allowed to get "His own answer." 6. States an idea and then does something to get data to test the idea. 7. Becomes actively involved after period of inactivity. 8. Provides feedback when teacher checks his perceptions. 9. Asks if his idea is good or right. 10. Asks for the "right" answer.	1. Senses power in his own ideas. 2. Challenged to find ways of finding his own answer. 3. Feels frustrated when he can't get closure. 4. Trusts teacher and other students. 5. Values his own abilities to build an idea. 6. Willing to stand alone or express a "way out" idea.

INTENT	T. ACTION	S. ACTION	EFFECT
Purpose teacher has in mind.	Observable teacher behavior to fulfill intent.	Anticipated, observable response by the student to teacher's action.	Anticipated inner state of student in response to teacher's action.
Intention I: Make data available to students when they request it.	1. Says, "yes," or "no", if student requests data through question that can be answered this way. 2. Answers a student's data request question by providing data. 3. Makes available books, prints, equipment, other resources at student's request for data. 4. Asks another member of the group if he has data that is being requested by student. 5. Arranges for visit to primary data source when such data is requested by students.	1. Asks for data. 2. Asks if he can go to data source. 3. Selects more than one data source. 4. Consults one data source and then turns to another. 5. Makes four, five, six data probes in rapid order. 6. Follows the statement of a theory with data probe to test his theory. 7. Performs an experiment verbally, that could only be duplicated in finest clinical settings. 8. Uses both verification and experimentation operations. 9. Goes to data source spontaneously.	1. Feels in control of his own data processing. 2. Feels power in being able to build his own ideas rapidly. 3. Values data as basis for building and testing ideas. 4. Evaluates data against source.

INTENT Purpose teacher has in mind.	T. ACTION Observable teacher behavior to fulfill intent.	S. ACTION Anticipated, observable response by the student to teacher's action.	EFFECT Anticipated inner state of student in response to teacher's action.
Intention I: Have students initiate their own action and provide "think" time.	1. Gives problem event and focusing question, then waits until students talk. 2. Waits when there is a lull in the discussion for a student to talk. 3. Waits, when a student is talking then stops, for the student to go on or say he is through. 4. When students ask for "conference", moves away from the conference and waits for it to end.	1. Breaks the silence by asking a question or making a statement. 2. Breaks the silence by giggling or laughing. 3. Breaks the silence by talking to another student. 4. Remains quiet up to a minute of silence. 5. Begins to talk whenever there is a moment of silence. 6. Having asked for conference, moves away from teacher.	1. Feels uncomfortable during periods of silence. 2. Appreciates period of silence being allowed. 3. Values periods of silence as time to organize own thoughts. 4. Says something or takes action because he needs to, not because he thinks someone expects it.

OBSERVABLE STUDENT ACTIONS INDICATING INTUITIVE RESPONSE:

This list is a summary of the student actions taken from the student action columns found on the preceding pages. They are the student behaviors which a teacher can theoretically expect when using the allowing inquiry moves. They are the behaviors which define the "Inquiring Student" at the level where he is acting rather naturally in terms of his own expectations, interests and needs rather than those of the teacher.

1. Asks questions about the problem.
2. Shares an idea about the problem.
3. States a problem after seeing a problem event.
4. Asks questions about a problem he has identified.
5. Identifies a problem not recognized by the teacher or another student.
6. Gathers data through different operations.
7. Asks the teacher if his idea is right.
8. Shares an idea without asking the teacher if his idea is right.
9. Shares an idea which is "far from convention or stereotype."
10. Asks for the "right" answer.
11. Asks if he can go to data source.
12. Performs the operation suggested by the teacher.
13. Follows the example given by the teacher and performs the operation.
14. Asks for data in response to teacher's data clue.
15. Shares an experience he has had.

RATIONALE FOR TEACHER TACTICAL MOVES:

This page is included to answer the question, "Why should the teacher use the moves allowing inquiry?" It establishes a rationale of teacher behavior where the teacher values facilitating student inquiry.

Focus Setting	Inquiry to be productive and meaningful must have direction and purpose.
Structuring	If students are to develop autonomy, they need to understand their decision-making role.
Clarifying	The teacher must understand what students are saying if he is to help the student develop an individual, personal idea.
Accepting	Students are more apt to share ideas and find ways of judging their ideas if the teacher's role is to listen and accept ideas rather than to judge them.
Responding to Data Probe	Students need to program their own data input if they are to build ideas and make judgments which have meaning to them. Students become aware of the processes for building personal knowledge when they can control the data input used in developing their own ideas. Only the student has knowledge of what data is relevant to the idea he holds or that he is building.
Silence	Students will never take action on their own if the teacher is always the initiator of action. Students and teachers need "think" time to develop processes for building personal knowledge.

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[1] For more detailed information, see:

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THE STUDENT'S WORLD*

Philip W. Jackson

When you were a child, how many times did you find yourself cornered by an adult, usually a strange aunt or uncle, who opened the conversation with that oldest of all gambits: "Well, how do you like school?" As an adult how often have you been left alone with someone else's child and, not knowing what else to say, found yourself falling back on some variant of the standard query: "How's school?" If you have not had both of these experiences, and each of them several times, you must be something of a recluse, for talk about school, when the dialogue is between an adult and a child, is almost as popular a social maneuver as talk about one's health or the weather.

Yet such talk, despite its popularity, rarely yields much information about what life in school is really like or how that life is experienced by the student to whom we are speaking. There seem to be two major reasons why this is so. First, in most instances neither the child nor the adult takes the query seriously. Both know that questions about school, like questions about personal health, are polite social gestures and usually are not intended to be answered fully or honestly. Thus, when asked about his classroom experiences, the fourth-grader who is having a miserable time with long division and who hates his teacher with a deep and abiding passion knows that he is expected to respond in much the same way as the victim of a migraine headache whose health is inquired into. Custom requires both sufferers to grin and say, "Fine, thank you."

A second limit to what we can learn about school life by talking to students arises from the fact that students may themselves not be acutely aware of what is happening to them in the classroom. Or, more precisely, they may never have tried to express the vague feelings and intuitive knowledge engendered by the experience. School life, like life in the military service, is not easy to describe to outsiders. You have to have been there.

But even being there is not enough, for when fellow students, or army veterans, discuss their common experience they often overlook or fail to mention some of the obvious and pervasive aspects of that experience. And often it is these familiar and seemingly trivial features of life that are the most revealing when it comes to capturing the flavor or unique quality of membership in a social institution. Accordingly, the remainder of this essay will focus on some aspects of school life that students rarely talk about in the presence of adults or even, in all probability, in the presence of other students.

The subjects to be discussed are not dramatic, or even intrinsically interesting, though I shall do my best to keep them from becoming deathly dull. What is more important, they concern things we all know, even though we do not think about them too much. My only justification for asking you to attend to such mundane matters is my hope that a consideration of these trivial but neglected events will

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deepen our insight into the character of the student's world and, hence, might lead us to ask new questions about our responsibility for establishing and maintaining that world.

Two warnings are necessary. First, I do not bring words of uplift and inspiration. In fact, some of the things I am going to say about schools and schooling will not be pleasant. They may even sound harsh. But I am convinced that educators are ready for such talk, provided it stems from good intentions, and that they prefer frankness, even though it may hurt, to the sticky sentiment and cliches that have come to characterize educational discussions from college courses to inservice workshops. Second, I am not going to present a plan of action for your consideration. Indeed, I am going to raise many more questions than I shall answer. Here again, I believe that more and more teachers are becoming tired of hearing experts, whether from the university or the central office, hand out the latest panacea for eliminating our educational woes. For a change, therefore, I will ask you to do nothing but think. If there are practical implications that follow from what I have to say, it is up to you to find them.

THE SOCIAL TRAFFIC OF THE CLASSROOM

Anyone who has ever taught knows that the classroom is a busy place, even though it may not always appear so to the casual visitor. Indeed, recent attempts to describe that busyness have yielded data that have proved surprising even to experienced teachers. For example, we have found in our studies of elementary-school classrooms that the teacher engages in as many as a thousand interpersonal interchanges each day. No comparable data are available for high-school teachers, but there is reason to believe that the interpersonal demands are equally severe at that level. A look at these and other demands is instructive as we try to understand what life in the classroom is really like.

First, consider the rapidity of the teacher's actions. What keeps her hopping from Jane to Billy to Sam, and back again, in the space of a few seconds? Clearly much of this activity is done in the interest of instruction. In most classrooms the teacher acts as a gatekeeper who manages the flow of interaction. When more than one person wishes to say something (a common condition in educational gatherings), it is the teacher who decides who will speak and when. Or we might turn our observation around and say that it is the teacher who determines who will not speak, for usually the number of students who want to say something exceeds the number who are granted the privilege.

SUPPLY SERGEANT

Another time-consuming task for the teacher, at least in the elementary school, is that of serving as a supply sergeant. Classroom space and material resources are limited, and the teacher must allocate these resources judiciously. Not every student can use the big scissors at once; only one child at a time can look through the microscope or drink from the drinking fountain or use the pencil sharpener. Again, it is important to recognize that the number of students who want to use these resources at any given moment is often greater than the number that can use them.

Closely related to the job of doling out material resources is that of granting special privileges to deserving students. The teacher frequently must decide whether a student is to be allowed to hand in his homework paper late or make up a quiz that he missed or have an extra day to finish his laboratory assignment. In elementary-school classrooms it is usually the teacher who assigns coveted duties, such as serving on the safety patrol, running the movie projector, or clapping the erasers. Students soon learn that in school, as in life in general, many are called, but few are chosen.

OFFICIAL TIMEKEEPER

A fourth responsibility of the teacher, and one that calls our attention to another important aspect of classroom life, is that of serving as an official timekeeper. The teacher sees to it that things begin and end on time, more or less. He determines the proper moment for switching from discussion to workbooks, or from spelling to arithmetic. He decides whether a student has spent too long in the washroom or whether those who take the bus may be dismissed. In many schools the teacher is assisted in this job by elaborate systems of bells and buzzers, but even when the school day is mechanically punctuated by clangs and hums, the teacher is not relieved of his responsibility for watching the clock. School is a place where things often take place not because people want them to, but because it is time for them to happen.

Our concern here is with the student and the quality of his life in the classroom. Therefore, the frenetic activity of the teacher, as she goes about calling on people, handing out supplies, granting privileges, and turning activities on and off, is of interest to us only insofar as the student experiences that behavior. We are interested, in other words, in what it is like to be on the receiving end of the teacher's action.

To begin, it is safe to say that for most students, some of the time, and for some students, most of the time, the classroom is a great place to be. When new insights are formed and mastery is achieved, when the teacher's queries can be answered with confidence, when privileges are granted and praise bestowed, when natural interests and desires coincide with institutional expectations--at such moments (and such moments do occur more or less regularly for many students) life at school must be extremely satisfying. A sufficient number of such experiences might well create the desire for further education and could set the stage for a lifetime of scholarship and academic pursuits.

But it is probably also true that for most students, some of the time, and for some students, most of the time, the classroom comes close to resembling a cage from which there is no escape. When activities are dull and repetitious, when the student is not called on even though he has signalled the desire to be heard, when privileges are not granted and blame, rather than praise, is bestowed, when natural interests and desires are antithetical to the demands of the institution--at such moments (and such moments probably occur more or less regularly for many students) life in school must be extremely irksome.

The important point is that these unpleasant aspects of school life are experienced

not only by those who are failing in their school work (although students with low achievement might receive more than their share of these discomforts). Nor are they simply a function of the cantankerousness or maladroitness of particular classroom teachers (although poor professional preparation and psychological disorders of teachers may well add to the student's burden). It would seem, in other words, that much of the pain of school life is a natural outgrowth of the problems of institutional living and the management of social traffic. Given the arrangement in which one person is chiefly responsible for serving the educational needs of thirty or thirty-five others and for articulating the demands of this group with those of several other groups in the same building, three of the most salient features of school life -- delay, denial, and interruption -- are almost inevitable.

DELAY

Consider for a moment the frequency of delay. When we examine the details of classroom life carefully, it is surprising to see how much of the student's time is spent in waiting. In the elementary school, the students often line up for recess, for lunch, and for dismissal, and they frequently have to wait for the lines to be straight before they move. During individual seatwork they wait for the teacher to come around to their desk to inspect their work. When the whole class is working together, there is the waiting for the slower pupil to finish the work that the faster ones have completed. During discussion there is the waiting for fellow students to answer the teacher's query. When motion pictures or slides are shown, there is usually a delay as the room and the equipment are made ready. As time for the bell approaches, students are waiting for it to ring, even though they may still have their eyes on the teacher.

No one knows for sure how much of the student's time is spent in neutral, as it were, but it is certainly a memorable portion. How many of us who have lived thousands of days in schools can remember waiting anxiously for the minutes to tick away until the dismissal bell freed us? How many of us whose lungs are lined with chalk dust can recall the hours spent looking out the classroom window as we waited for the group in which we were imbedded to move sluggishly along? How many of us respond sympathetically to the following image of school life presented by George Santayana, as he describes his student days at Boston's Boys Latin School: "No blackboard was black; all were indelibly clouded with ingrained layers of old chalk; the more you rubbed it out, the more you rubbed it in. Every desk was stained with generations of inkspots cut deeply with initials and scratched drawings. What idle thoughts had been wandering for years through all those empty heads in all those tedious school hours! In the best schools almost all schooltime is wasted."[1]

Idleness, unfortunately, is only part of the picture, and perhaps not even the most important part. Waiting is not so bad and may even be beneficial when the things we are anticipating ultimately happen. Indeed, Longfellow was probably speaking

[1]From George Santayana, "The Latin School" in Unseen Harvests, edited by Claude M. Fuess and Emory S. Basford (New York: Macmillan, 1947), p. 487.

with the voice of wisdom when, in his Psalm of Life, he advises us to "Learn to labour and to wait." But he was just a shade too optimistic when, in another poem (the title of which ironically is The Student's Tale), he promises his reader that "All things come round to him who will but wait." At least it is doubtful that Longfellow was referring to things that go on in classrooms, for there the waiting is sometimes in vain.

DENIAL

The denial of desire is commonplace in school, and likely it has to be. Not everyone who wants to speak can be heard, not all the student's queries can be answered to their satisfaction, not all their requests can be granted. It is true that, considered individually, most of these denials are psychologically trivial; but considered cumulatively, their significance increases. Part of learning how to live in school involves learning how to give up desire as well as waiting for its fulfillment.

Typically, things happen on time in school, and, as a result, activities are often begun before interest is aroused and terminated before interest wanes. Once again, there is probably no alternative to this unnatural state of affairs. If we were to wait until students requested a history class on their own, as an instance, we would have a long wait. Similarly, if we allowed students to remain in their physical education classes until they grew tired of the game, there likely would not be time for other things. There seems to be no alternative, therefore, but to stop and start things on time, even though it means constantly interrupting the natural flow of interest and desire for at least some students.

INTERRUPTIONS

But interruptions in the classroom are not confined to the beginning and ending of subject-matter periods. There are also more subtle ways in which activities are broken into. The irrelevant comment during class discussion, as an instance, often breaks the spell created by the relevant remarks that have preceded it. When the teacher is working individually with a student while others are present--a common arrangement in elementary school classrooms--petty interruptions, in the form of minor misbehavior or students coming to the teacher for advice, are the rule rather than the exception. In countless small ways the bubble of reality created during the teaching session is punctured, and much of the teacher's energy is spent in attempting to ignore them. Students are constantly "turning back" to their studies after their attention has been momentarily drawn elsewhere.

Here, then, are three of the unpublicized features of school life: delay, denial and interruption. As educators what do we make of them? Or better, what should we make of them? Let's dispense with extreme reactions first.

On the one hand, there is the temptation to ignore these aspects of classroom experience. After all, delay, denial, and interruption are features of life in several other settings. Why pay particular attention to these petty annoyances when they occur in school? Students themselves do not seem to be too upset by these occurrences, the argument continues; therefore, it is probably safe to ignore them,

with perhaps a passing cluck of disapproval, and move to more pressing educational problems.

On the other hand, there is the temptation to magnify these undesirable events until they become all that can be seen of school life. This alternative, which might be called the school-is-hell approach, seems to be dominant on many of our college campuses these days. It is the credo of the new undergraduate religion: anti-establishmentarianism.

The trouble with these extreme positions, as with most, is that they can be maintained only by choosing to ignore certain salient features of our educational scene. Defenders of the optimistic leave-well-enough-along point of view preserve their calm by remaining blind to the fact of widespread discontent in our schools. Defenders of the school-is-hell point of view must keep the edge on their fury by failing to acknowledge that there is massive satisfaction as well as massive dissatisfaction in our classrooms.

A more dispassionate point of view, although one that is unlikely to capture newspaper headlines, might lead us to examine the strategies that students develop to adapt to these mundane features of school life. What must be done, in other words, if the student is to live a large portion of his life in an environment in which delay, denial, and interruption are inevitable? Further, how do the strategies for adapting to these demands combine with, complement, or contradict the strategies for acquiring knowledge and developing intellectual mastery?

PATIENCE AND RESIGNATION

The quintessence of virtue in an institutional setting is contained in the single word: patience. Without that quality life can be miserable for those who must spend time in our prisons, our hospitals, our corporation offices, and our schools. But virtue can become scured if tested too severely. And the conditions that lead to the development of patience can also, if carried too far, set the stage for the development of resignation--a much less virtuous condition. Indeed, the distinction between the patient person and the resigned person is not always easy to make on the basis of surface appearances, even though there is a world of difference in the psychological strength of the two.

While the patient person maintains a firm grasp on his own plans for the future and, hence, retains a sense of integrity, the resigned person does not. Resignation involves an act of psychological surrender in which one's own desires, plans, and interests are abandoned and action is taken on the basis of the desires, plans, and interests of others. The resigned person has not only given up hope, he has given up many other linkages between his motives and his actions. Resignation involves, in other words, a loss of feeling and a sense of no longer caring about what happens.

Returning to the situation in our schools, we can see that if students are to face the demands of classroom life with equanimity--rather than with disappointment, anger, and rebellion--they must learn to be patient. This means that they must be able to disengage, at least temporarily, their feelings from their actions. The hope is that the disengagement will not become permanent, that patience will not fade imperceptible

tively into resignation. Yet in expressing this hope we acknowledge a real danger, for the one condition lies just beyond the other, along the same path. The problem for the teacher is to help students become uninvolved when conditions demand it, but not too uninvolved. We want students to be calm in the face of some of the frustrations caused by collective life in an institution, but we do not want them, in the jargon of adolescence, to "cool it."

MASQUERADE

The second-grader who groans with disappointment when an enjoyable classroom acitivity is terminated, and the fourth-grader who zestfully waves his hand while his classmate is struggling to answer the teacher's question, both will likely be transformed by the time they reach high school or college into the jaded "professionals" of the classroom--those living inkblots whose enigmatic silence and languid slouch effectively mask both the presence and the absence of enthusiasm for educational affairs. Which ones are merely being patient, and which resigned? It is sometimes hard to tell.

Students also know that teachers like to see evidence of enthusiasm and involvement, and this knowledge causes alertness and other signs of interest to be worn as masks in much the same way as signs of indifference. Classroom courtesy demands that you keep your eye on the teachers and frown intensely at appropriate times even though your mind may be miles away. Again the teacher is faced with the problem of deciding which students are really with her as she goes about her work and which ones just appear to be with her.

The business of faking involvement and of masking withdrawal is not limited to the simple procedure of showing signs of attention when class is in session. These are not the only strategies by which students adapt to classroom demands. Nor are delay, denial, and interruption the only unpleasant aspects of school life with which the student must cope. The classroom, it must be remembered, is an evaluative setting in which the student must learn not just to comply with commands, but to comply in a way that yields a positive evaluation.

Thus arises the common practice of giving the teacher what she wants on written assignments and test questions, even though the assignments seem meaningless and the questions inane. Along with this practice goes the technique of disguising ignorance, of responding to the teacher's queries with sufficient ambiguity or with only thinly veiled flattery so that she will not discover and no longer care whether the student knows anything or not. (When I was a high-school student, this ploy was known as giving the teacher a "snow job." I do not know what name it goes under these days, but I am fairly confident that it is still being practiced.)

These forms of student behavior may be laughed off as harmless pranks, and sometimes they are nothing more than that. But all these acts of detachment and deception, each of which might be considered harmless, or even "cute," when used in moderation, grow out of attempts to deal with institutional constraints. When used excessively and in combination, they are the marks of the educational con-man, the student who has learned to size up teachers and give them what they want with all the shrewdness and feigned sincerity of a dishonest secondhand car dealer.

THE TWO CURRICULUMS

Much that has been said up to this point can be summarized by suggesting that every school and every classroom really has two curriculums that the students are expected to master. The one that educators traditionally have paid the most attention to might be called the official curriculum. Its core is the three R's, and it contains all of the school subjects for which we produce study guides and workbooks and teaching materials. It is the curriculum that all the curriculum reform groups are shouting about these days.

The other curriculum might be described as unofficial or perhaps even hidden, because to date it has received scant attention from educators. This hidden curriculum can also be represented by three R's, but not the familiar one of reading, 'riting, and 'rithmetic. It is, instead, the curriculum of rules, regulations, and routines, of things teachers and students must learn if they are to make their way with minimum pain in the social institution called the school.

THE REWARD SYSTEM

Two or three important observations might be made about the relationship between these two curriculums. One is that the reward system of the school is tied to both. Indeed, many of the rewards and punishments that sound as if they are being dispensed on the basis of academic success and failure are really more closely related to the mastery of the hidden curriculum. Consider, as an instance, the common teaching practice of giving a student credit for trying. What do teachers mean when they say a student tries to do his work? They mean, in essence, that he complies with the procedural expectations of the institution. He does his homework (though incorrectly), he raises his hand during class discussion (though he usually comes up with the wrong answer), he keeps his nose in his book during free study period (though he does not turn the page very often). He is, in other words, a "model" student, though not necessarily a good one.

It is hard to imagine any of today's elementary school teachers failing a student who tries, even though his mastery of course content is slight. And elementary school teachers are not alone in this respect. At higher levels of education as well rewards go to the solid citizen as well as to the budding scholar. Surely many of our valedictorians and presidents of our honor societies owe their success as much to institutional conformity as to intellectual prowess. No doubt that bright eyed little girl stands trembling before the principal on graduation day arrived there at least partly because she typed her weekly themes neatly and handed her homework in on time.

This manner of talking about educational affairs may sound cynical and may be taken as a criticism of teachers or as an attempt to subvert the virtues of neatness, punctuality, and courteous conduct in general. But nothing of that kind is intended. The point is simply that in schools, as in prisons, good behavior pays off.

Just as conformity to institutional expectations can lead to praise, so can the lack of it lead to trouble. As a matter of fact, the relationship of the hidden curriculum to student difficulties is even more striking than is its relationship to student successes. Consider, as an instance, the conditions that lead to disciplinary action in

the classroom. Why do teachers scold students? Because the student has given the wrong answer? Or because, try as he may, he fails to grasp the intricacies of long division? Not usually. A student is more likely to be scolded for coming into the room late or for making too much noise or for not listening to the teacher's directions or for pushing while in line. The teacher's wrath, in other words, is commonly triggered by violations of institutional regulations and routines rather than by the student's intellectual deficiencies.

Even with the more serious difficulties that clearly entail academic failure, the demands of the hidden curriculum lurk in the shadows. When Johnny's parents are summoned to school because their son is not doing too well in arithmetic, what explanation will be given for their son's poor performance? More than likely blame will be placed on motivational deficiencies in Johnny rather than on his intellectual shortcomings. The teacher may even go so far as to say that Johnny is unmotivated during arithmetic period. But what does this mean? It means, in essence, that Johnny does not even try. And not trying, as we have seen, often boils down to a failure to master the hidden curriculum.

There is a further question that must be asked about the relationship between the official and the unofficial curriculums in our schools: To what extent does the mastery of one interfere with the mastery of the other? In other words, how do the demands of intellectual achievement relate to the demands of institutional conformity? Are they complementary or contradictory?

We have already seen that many features of classroom life call for patience, at best, and resignation, at worst. As the student learns to live in school, he learns to subjugate his own desires to the will of the teacher and to subdue his own actions in the interest of the common good. He learns to be passive and to acquiesce to the network of rules, regulations, and routines in which he is imbedded. He learns to tolerate petty frustrations and to accept the plans and the policies of higher authorities, even when their rationale is unexplained and their meaning unclear. Like the inhabitants of other institutional settings he learns that he must frequently shrug and say, "That's the way the ball bounces."

But the personal qualities that play a role in intellectual mastery are of a very different order from those that characterize the Company Man. Curiosity, as an instance, that most fundamental of all scholarly traits, calls forth the kind of probing, poking, and exploring that is almost antithetical to the attitude of passivity that has just been described. The productive scholar must develop the habit of challenging authority and of questioning the value of tradition. He must insist on explanations for things that are unclear. The scholar must certainly be a disciplined man, but his discipline is developed in the service of his scholarship, rather than in the service of other people's wishes and desires. In short, intellectual mastery calls for sublimated forms of aggression rather than submission to constraints.

DOCILE SCHOLARS

These brief descriptions exaggerate the real differences between the demands of institutional conformity and the demands of scholarship, but they do serve to call

our attention to points of possible conflict between the two sets of demands. Can both sets be mastered by the same person? Apparently so. Certainly not all our student council presidents and valedictorians are academic Uriah Heeps. Some have clearly managed to retain their intellectual aggressiveness while at the same time acquiescing to the laws that govern the social traffic of our schools. Apparently it is possible, under certain conditions at least, to breed docile scholars, even though the expression might appear at first glance to be a contradiction in terms. But how are these successes achieved? At what cost? And how many fail to achieve the synthesis of the so-called well-rounded student?

A SOCIAL PRICE

The cost of scholastic success must be measured not only in terms of the intellectual energy expended or the non-academic gratifications denied. For many students who accede willingly and sincerely to both the intellectual and the institutional demands of the school run the risk of being perceived as defectors by their peers. At the lower levels of education these students are likely to be called goody-goodies, tattletales, and teacher's pets; at the upper levels they are called greasy grinds, eager beavers, and squares. In the eyes of many of their classmates the students who receive the highest praise from the authorities of the school are the ones who have sold out to the system. For many students this kind of name calling, which is often correctly perceived as reflecting envy, is not difficult to endure and is a small price to pay for the admiration of adults whom they respect. For other students it is more important to appear to be a "regular guy." Many would rather be seen as a "buddy" than as a "brain."

The number of failures in our schools is much larger than the number of students who do not come up to snuff on our achievement tests or final exams. The failures include an untold number who seemingly succeed but who turn off their intellectual motors when the dismissal bell rings. These children have learned how to give the teacher what she wants all right, but in the process they have forgotten how to use their mental powers to give themselves what they want when the teacher is not around. This group includes the students who make the honor rolls and the dean's lists during the school year but who do not know what to do with themselves during the summer vacation. It includes the thousands who, after their formal schooling is finished and diploma hung on their wall, will never again be stirred by the quest for knowledge. It includes the millions for whom a childhood of teacher-watching is followed by an adulthood of television-viewing, with hardly a change of postures or facial expression to mark the transition. One almost expects them to raise their hands and ask Johnny Carson if they can go to the bathroom. Adequate as students? Yes. Adequate as adults? No.

TWO WORLDS

And who is to blame for these failures? The schools? The society? The individual? All three share the responsibility, I suppose, but it is the school's role with which we are particularly concerned at present. The school, it would seem, asks the student for a commitment to two worlds--the world of the institution and the world of scholarship. Unfortunately, it often succeeds in obtaining only a feigned commitment to either one.

What about our own commitment to these two worlds? How have we partialled out our own loyalty? How much have we ourselves become Company Men, more interested in an up-to-date register than an up-to-date idea, more concerned with straight lines than with straight thinking? After all, we too, like our students, are rewarded for doing things neatly, and on time, with a minimum of fuss and bother. How often have we received compliments from our principals for the surface show of scholarship, for the attractiveness of our bulletin boards rather than for the vigor and imaginativeness of the ideas we present to our pupils? Nor are our administrators the villains of the piece, for they, in their turn, are caught in the same bind. The public wants its institutions to be run quietly, efficiently, and economically. The best attended school board meeting is almost always the one at which the budget is discussed. And who is this elusive public but the very people we educators had yesterday in our classrooms. So the circle is complete. No one is responsible, yet everyone is.

What, then, is life like in school? It would seem to be a life of contradictory demands and competing tendencies, a life in which discovery and disappointment go hand in hand, where the unpredictable and the routine are combined daily. These monotonous settings of desks and blackboards and books provide a stage for the cyclic enactment of a dull drama, a play that is at once boring and exciting. No wonder our young friend only says, "Fine!" when we ask him how things are going in the classroom. School is a puzzling place, and the puzzles are not all intellectual ones.

THE POWERS OF CHILDREN*

Caleb Gattegno

Most of the things that are without importance to educators today, are the source of what is going to make us do a much better job in education.

What is the task of education? Is it not to provide students with the means to meet the future?

There is one thing that we all agree about with respect to the future, and this is that it is unknown--unknown absolutely if we project far enough and relatively if we consider the relationship of tomorrow to yesterday, which seem not so different.

In devising a system of education, man may wish to stress what remains constant after the passage of time, but he can equally well stress that our world is becoming more and more "manmade" as against "natural," and that in such a world we would be on very shaky ground if we identified what will be with what is. The only way to be properly prepared and secure in a changing world is if we accept the future as unknown. (But really the world is always changing.) Such a view is all the more persuasive when we see that it leads to suggestions for doing the job of education that are at least as good as those that follow if we separate the remote and near future and treat them differently. That we must prepare for the unknown is my approach to education--and in a sense is everyone's approach.

Teachers in traditional schools--the schools we have today--know that what they know and have to teach is unknown to the learners. And they believe that they are making the unknown known by imparting their knowledge to their students. But has this belief proved right? How many readers of this book, for example, understand everything their teachers taught them? Or sixty or forty percent? And to what extent has the sixty or forty percent enabled them to meet what is new and strange? The answers are self-evident. Unfortunately, the traditional approach has not worked well. On the other hand, a method of educating for the future does exist--if we know how to acknowledge what is given us and already is in us, and with this, encounter what is but is not yet part of us.

It happened that every one of us as a child did precisely this. For a while we did not talk, we did not speak, and after a while we did both. That is to say, we met what was and we managed to make it our own. So every one of us as a child was really facing the unknown, meeting the unknown, and developing the techniques for doing it. But when we went to school, we found another technique in use: someone told us what was supposed to be known by us. Teachers told us, "You should know it," and the reason was, "Because I told you"--arrived at by putting together two ideas that are entirely unrelated: the pronouncement by the teacher and the retention or understanding by the student.

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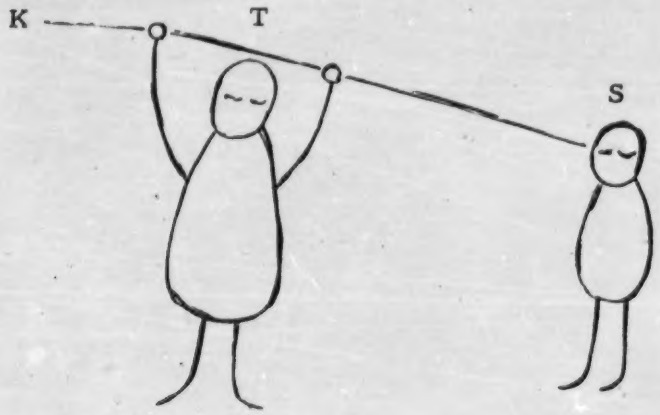
*From What We Owe Children by Caleb Gattegno. Copyright © 1970 by Caleb Gattegno.

Two roughly drawn diagrams will assist us in comparing the way of working that is from the teacher to the student--the traditional method of schooling--and the way of working that is from the student to the world--the method of subordinating teaching to learning. The first diagram portrays the standard way of teaching.



In this approach, knowledge is conceived as pre-existing and as coming down, through the teacher, from those gifted people who managed to produce it. (Let us note that in this country, the phrase "knowledge industry" expresses just such a view of knowledge.) It is stored in special places called libraries which have books and more modern forms of containers. People who want knowledge have to go there and pick it up, in much the same way that they would acquire any other manufactured product.

Teachers are those people who take knowledge down from the shelves where it is displayed and hand it out to students who presumably need only memory in order to receive it. This process is conceived as the way the student comes to own knowledge. The key to this view--and to the whole traditional way of teaching--is the tacit belief that memory is a power of the mind.

Obviously it is. But still, memory can be strong or weak. La Rochefoucauld said around 1660 in a very short statement: "Man gladly complains of his memory, but not of his intelligence." Was he correct in his implication that memory is in fact a weak power of the mind?

To see that it is we need go no farther than to look at what is done by teachers in order to insure that their students retain the knowledge handed down to them.

Teachers give a lesson, thinking that they are passing knowledge on to their students, but since they do not actually know whether they have succeeded, they proceed to give the students exercises.

Why do they give exercises? So that what they themselves cannot do, the exercises will do: get the knowledge securely into their students.

But exercises usually are not sufficient, so teachers also give homework. What

does homework do? What a teacher cannot do. If the teacher could finish the job in school during school hours, there would not be any need for any homework. That is why students get homework.

It does not end there either. There are also reviews. On Monday morning the class reviews what was done the week before. In January the class reviews what was done last term. And next year what was done the previous year. Teachers not only review and review, they also test whether students still hold the knowledge. And they do not stop with one cycle of reviewing and testing. Reviewing and testing goes on for years because teachers know that many of their students do not retain the knowledge they are presented with.

So there is this accumulation of props, all to sustain the poor weak memory.

But nobody says that exercises, homework, reviewing, testing, then more exercises, more homework, more reviewing, more testing, and on and on, are there because memory is weak. We do not say that the whole traditional education is based on something that is weak, and that therefore the basis of education should not be memory. Yet the education offered in traditional schools--at least when we are concerned with transmission of knowledge--is described with precision by the above remarks.

This we call the subordination of learning to teaching, illustrated in the first diagram. I hope no reader believes I am trying to ridicule the situation with this diagram. For me, it is an exact illustration. The teacher with one hand gets some knowledge and with the other hand gives it out: that is the operation.

An advantage of such a teaching procedure is that it can be explained at the college level. Professors can explain to teachers how to present a subject and how to refine a presentation. Indeed, in their explanations they use the same approach they are passing on. The diagram applies equally to the work done at institutions of higher learning.

To understand that there once was good reason for Man to choose memory as the channel of instruction in spite of its inadequacies we need only to look back and place ourselves at a time when ways of recording events had not yet been invented. In our individual experience, then and now, we find that much of what we know how to do--talk, walk, breath while eating, etc.--expresses itself in automatic unconscious functionings often difficult to objectify and thus inaccessible to other people. On the other hand, the content of tales, legends, stories, gossip, etcl, if repeatedly told, gains an existence of its own which we can attempt to preserve per se as we do objects. When recording of events was not available, the quality of the mind socially most valued was faithfulness (fidelity in the modern electronic sense), and verbatim retention became the highest attribute of a good mind. Since as children we show retention best after we have learned to talk, verbal retention understandably became the object of the care of teachers whether at home, in the forum, or at school. Tests in such a social setting were tests of retention for those who carried the tribal traditions.

When recording appeared, the attribute of retention could be weaker per se since it was supported by the record, and in fact it soon became second best to the record. But this change did not make societies discard the use of memory as the basis for teaching. There still was a stress on traditional transmission; no more individually oriented method of transmission had yet become acceptable to the Establishment. A stable society uninterested in questioning tradition was served well by transmission of well preserved statements about wisdom and truth.

But in a changing world one discovers that the ability to forget is needed as much as the capacity to retain and that there is no value in taking the time to fix in one's mind what no longer obtains. No one in such a world is prepared to pay a heavy price for what is no longer functional. This is the situation today. The success, such as it is, of the present system of education through memory results in fact from our own spontaneous use of ourselves as we go beyond the epistemology that describes our growth as greater and greater retention and shift ourselves to other ways of knowing.

Now, what is the alternative to the use of memory?

The alternative is to build on strength. And strengths exist. These I call the functionings of children, and they are the basis of all individual education, and now can be made the basis of institutional education.

What are the functionings of children? They could all become known to us because we all have been children. We have used these functionings, we have them in us, and we did with each such a good job, mastering it so successfully, that we do not have to do it again (except in an extreme situation, as with an accident that takes, say, half of one's brain, after which one has to learn to use the other half for the functionings involved with the missing half). On the whole, for example, we learned so well to sit that we do not have to learn to do it ever again. Sitting is one of the functionings of children.

When I was in my crib I worked tremendously hard. I knew that if (while lying on my back) I lifted my legs--which were quite easy to lift--with muscles reachable by my will, I was helping myself to learn to sit. Nobody showed me how to sit. Was any reader of this book taught to sit? Each person looked toward himself and saw for himself the problem of being on one's back and of learning to sit. One cannot say that sitting is instinctual. It takes months to learn. A man is not a little goat who is born having already practiced lots of things and an hour after its birth is standing on its feet. At six months I had not sat before. My mother did. I did not. I had to learn how to sit, and this I did for myself, as every reader did it for himself, in the crib.

If a child's accomplishments in his crib are not impressive, then nothing is impressive. There is no end to the (extraordinary) functionings we all accomplished as children. One of the most impressive is learning to speak. In my crib I discovered that if I worked on the muscle tone of my lips, that would permit me to gain entry into the field of the sounds of speech. I knew that I had to act on the muscle tone first, and by the sixth or seventh or ninth week of my life, I had learned the ways of doing this. And as I produced these ways I used my lips

straightaway to produce new sounds, which in turn made me aware of other ways and so on.

As a child, nobody reading this book ever heard a word. In fact nobody ever heard a word. Ears hear voices. And voices are all different. We hear voices, and they differ in pitch and in stresses. There are all sorts of variations: one can have a deep voice or a smooth voice, a very quick speech or slow speech, and so on. And out of all these voices that represent the reality of the environment, each of us has picked up that component that we learned to call word. Every one of us has recognized words as being something one can add to the functioning of the throat one owns so that a sound comes out in a particular guise and is recognized by others as having been produced by one's voice. Children do not learn by imitation, otherwise they would speak at different pitches to the various people they come in contact with. That they do not is one reason that makes us say that children learn to make words through the use of their own mental powers--and learn to do it so well that for their whole life thereafter (barring an unusual accident) they continue to make words without any conscious preparation. (There are other reasons: how can a child even see the tongue movements that, if he learned speech through imitation, he necessarily would have to duplicate in order to talk?)

What do we learn about the mental powers of children from the fact that the ability to make words becomes one of their functionings? We learn first of all that children are equipped--and we are all equipped--with the power of extraction, which obviously is very competent since it can find what is common among so large a range of variations.

Second, we have to acknowledge that children have the power to make transformations, for to learn to speak is to use transformations constantly. In every verbal situation in which someone is trying to tell us something, the words are to be used by us as they are by the others. The words cannot simply be repeated.

If someone says to me, "This is my pen," and I repeated it, I would be wrong; and if we were children, we might quarrel. Then perhaps I would see that I have to say something else to be at peace with the other person, and I might learn very quickly. In any case, I eventually will learn to say, "That is your pen."

Again, if I look at one person, a woman, and I talk to her, I will use the word "you." But if I look at her and talk of a third person, a man, I must say, "he." Such transformations go on all the time. Indeed, there would be no pronouns in a language if there were no such thing as transformation.

So this is a second power used by children in the process of speaking and developed by it.

Further, everyone who has learned to speak has demonstrated an enormous competence in handling abstractions, for no particular word has an exclusive meaning of its own.

Words are signs, arbitrary signs, since each object, for example, can have as many names as there are languages. Not only do children have to extract words

from the full packages represented by the voices they hear, they must also attach meaning to the words. Meaning must precede the grasp of what is used by the environment to refer to it.

Nouns, for example, cover classes of objects (car applies to all cars, glass to all glasses, whatever the make, shape, color, etc.). Verbs cover multitudes of actions or states (jump applies to a continuum of distances from the ground, cry to any cause for this kind of behavior). Adjectives cover spectra of impressions (red, rectangular, etc.) and so on. Children must learn to make the proper abstractions so as to give to words their particular agreed upon meaning, and they do learn.

No one can retain a noun without making allowance for all the changes in lighting, distance, angle of vision, etc., which constantly accompany our constant displacements in the environment.

So to talk I have to learn that I have to demonstrate that I can pick up--extract--something that is as subtle as words. I must recognize the word within the voice that is used. I must also recognize what transformation is required in going from one situation to another. And I must learn, which I do through my powers of abstraction, the meanings attached to words. Therefore I have a functioning as a speaker at the age of two, that could give me a doctorate, for no doctoral student in a university has ever done as good a job equivalent to what we all did when we were one and two years of age finding by ourselves how to acquire the extremely complicated system called language (which in English is more complicated than in many other languages).

Indeed because we all did it, it does not impress us very much. And in my career, in my work with developing new solutions to the problems of education, I have often been considered a fool for having been impressed. But when we look at children as owning the powers they actually have and at how they function, we are overwhelmed with the possibility for education. We are not discouraged, as we are when we look at memory as the only basis for progress.

There is one universal functioning without which nothing is noticed. This is the stressing and ignoring process.

Without stressing and ignoring, we can not see anything. We could not operate at all. And what is stressing and ignoring if not abstraction? We come with this power and use it all the time. I know that the pitch of my brother and the pitch of my father differ but I ignore the difference so as to comprehend that the words of one are comparable to the words of the other. I ignore that it is only the eye of my mother that I can see when she comes close to my cheek and kisses me. If I did not, the eye, quite likely would frighten me. But I ignore this, and I stress the smell of the person. From this I know it is my mother. That is, I can shift my attention to another attribute that also belongs to her. If I did not do that I would not know that it was my mother that kissed me. To stress and ignore is the power of abstraction that we as children use all the time, spontaneously and not on demand, though in its future uses we may learn to call it forth by demand. And teachers insist that we teach abstraction to children through mathematics at the age of twelve!

What does it mean to possess a functioning, to know as children know how to eat, how to sit, how to speak?

What reader of this article literally remembers his native language? Not one. None of us remembers it, we function in it, we have at our disposal the "know-how" to do it. This is what it means to have a functioning.

The know-how leads to skill, the know-how is what we have within us that does not require conscious recall. It is just there. If I had to remember my speech, I would never be able to talk. Anyone observing himself will see that to have an intention to speak is sufficient for all of one's verbal elements to be available and for finding them adequate for one's intention. An individual need not call in these elements one by one; they come, the intention brings the appropriate words in and excludes the others.

Further--and here we move to another point and another power of children--when the words come out, it is the will that acts upon the speech organ for the words to be spoken in the way that the language expects them to sound.

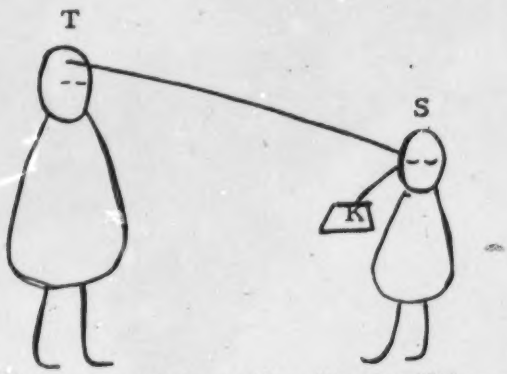
Hence, there must be within us a control system that guides the making of these sounds.

We have established this system in our crib, the feedback mechanism that exists between our utterances and our hearing. All day long the vigilant ear attends to our speech. And what we developed as a result is reliable most of the time. An individual knows when he has made a mistake. He says: "Oh, that is not what I wanted to say." It is the ear that tells him this, not the throat. This task of organization and coordination does not exist when we are first born, we discover it in our crib, and we use it, practice it, refine it, and make it more powerful until it becomes an instrument for knowledge--knowledge that is meaningful within the criteria we have.

Now, as soon as we shift from acquiring facts through memory to acquiring them through functionings, we unify our experience in the duration of one life--for we always build on and integrate with what already exists and do not simply pile one fragment of information upon another--and we recognize that inner meaning is more important than outside authority. Meaning for our psychosomatic organism exists if it either falls readily within the sense of truth already at work or can be integrated in an enlarged functioning of the sense of truth. But in either case it is the person doing to himself what is required in order to receive the new. Hence the person is judging whether there is a reality (within him or outside) that agrees with the existing functionings or requires the widening of oneself to integrate the new. This adaptation of the self to the world is proof both of the malleability of the self and, more directly to the point in this context, of the existence of inner conscious criteria capable of ordering either immediate integration or immediate change in order to achieve integration.

Such inner criteria, which all children have, are the epistemological consequence of the shift from an outside vision of man to one aware of individuals functioning for themselves in their world.

An approach to education that rests on the powers of children--the approach that I call the subordination of teaching to learning--can be illustrated in the following way.



Its contrast to the diagram illustrating the traditional approach is obvious.

Despite all that children know, in school we do not allow them to trust their own perception, only their teachers. At school, to the question "2 plus 3?" some children answer--"Five?" They do not answer "Five!" because they have not been allowed to believe in their sense of truth. So knowledge becomes something that is passed on to them. Not something they own. This is the consequence of teaching through memory and not by functionings, and it brings us to the one last power developed in the functionings of children that we need to examine for our present purposes.

The schools have a curriculum that is based upon the teachers providing children with showers of knowledge. Knowledge is so vast that, to make this approach manageable, we take a stretch of knowledge and divide it among thirteen or so years by separating it into little bits. And in its piecemeal quality, Chapter 1 of the first textbook resembles Chapter n of the last.

In the books for teaching a foreign language, for example, all the lessons have the same format. As if having learned something of the language does not change one. One always begins the same way and the lesson invariably follows the same pattern, ending in a test.

In this approach, there is no concern with one of the things that all of us know--that all of us go through--and that is, that practice gives one the capacity to undertake bigger tasks, to be involved in greater challenges. Is this not so? Is it not something that everybody knows, that practice provides us with the capacity to attack bigger tasks?

In my own case, I learned this as an adolescent when I lifted weights. Lifting weights teaches one a lot if one can learn more than lifting weights. I recognized that lifting weights made me have muscles that allowed me to lift bigger weights, and that when I lifted bigger weights, I got bigger muscles which allowed me to lift bigger weights.

But this is not the approach that we have imbedded in the curriculum. Instead we work in the same way throughout the entire curriculum and do not take into account

that there is a law--the law of the cumulative effect of learning--which can be described by saying once you have learned something, once you have mastered something, then you can attack a bigger task. The curriculum should be like a fan, opening up to more and more things, to bigger and bigger things.

These comments point the way to what we can learn from studying the functionings of children.

NEW CONCEPTIONS OF THE ROLE OF THE TEACHER*

Jerome S. Allender

The active development of new roles for the teacher begins with the re-creation of the context within which teaching takes place. Great satisfaction with the traditional roles of the teacher is not evidenced by general support coming from any corner; this fact, alone, is a sufficient argument for the direct application of innovative ideas to education. By carefully exploring different ways in which new contexts can be created, a teacher puts himself in a position of being able to make a rational decision concerning the degree of change he wants to attempt. Depending on the extent, this can range from an involvement in the normal evolutionary process that affects teaching to a radical approach to change.

Currently, several developments provide helpful bases for thinking about changing the context of teaching. Because it has been recognized for some time that individual differences have a significant effect in all learning, it is feasible to consider individualizing most of the instruction that goes on in one's class. Although less widely supported, the need to emphasize increased independent study and freedom of movement under less teacher direction, in what is called an open classroom, has also been strongly argued. Possibilities for implementing these ideas should be explored because both are conducive to the reconceptualization of the role of the teacher. A more progressive approach is to create a positive role for the teacher in an open classroom; this would involve reconstructing the context of teaching from the standpoint of a theory of student-directed learning. Rather than trying to follow the best avenues of traditional teaching or simply reducing the degree of directiveness, the development of new roles for the teacher can be attacked by focusing on the establishment of common meaning with students, the cooperative planning of teaching and learning, and the provision of choice at all times. In many schools, even for the experienced teacher, this approach may never be practical. However, it is worth reflecting on the kind of direction it can possibly give to teaching; and seeing how quickly the everyday world around us is changing, it may be impractical, particularly for the teacher-in-training, not to take this more radical approach.

I.

The most general basis for individualizing instruction comes from the broad study of individual differences including the varying points of view of biology, society, the school, the curriculum, and the teacher (Henry, 1962). Whether they are the result of genetic predispositions, varying abilities, previously acquired skills, or personal style, it is clear that individual patterns play an important role in learning. The problem posed for the teacher is that every child's program should somehow be geared to his unique learning needs. This supports the idea of making as much individual help available to students as possible, and it shows an advantage for grouping children who have similar needs. The main practical outcome has been

*Adapted from Chapter 5 of Jerome S. Allender, A Radical Psychology of Learning. Copyright, 1972 by Jerome S. Allender.

the increased availability of materials that allow children to work at their own level of readiness and at their own pace. In many schools, it is expected that ordinary classroom materials should be made available on an individual basis whenever possible, and a variety of individualized materials will be ordered if requested.

As a part of the emphasis on instructional materials, programed instruction was conceived and introduced (Pressey, 1964; Lumsdaine, 1964). Following Skinner (1968) for the most part, it is based on a theory that reinforcement is necessary for learning, or at least its best facilitator. Thus, programed texts characteristically have carefully sequenced short items or questions requiring easy-to-guess answers, and the correct answers are nearby for a student to check his own responses. It is assumed that a student's learning is reinforced whenever he finds that the response he gave to a particular question is correct. A body of research was undertaken to demonstrate the effectiveness of programed instruction, and not surprisingly, the evidence suggests that its utility depends on the materials, the students, and the teacher's goals (Allender, 1967). At times, though, it can be used quite effectively to help a group of students learn a given body of knowledge, and as a consequence of these encouraging results, another source of individualized materials in many subject-matter areas has become available. A broader concept of programed instruction has involved the use of computer-like approaches and actual computers (with multiple student stations) for the presentation of programed materials (Allender, 1967; Atkinson, 1968; Hansen, 1968). Easily capable of immediately indicating to students whether their answers are correct, they have also been used to implement programs of study involving complicated forms of feedback--like those that might be given by a tutor--to assist in the learning process.

The teacher's major role in a school where the majority of emphasis is on individualized instruction is obviously not to transmit information. Students are expected to be dependent mainly on instructional materials for acquiring knowledge, and the significant function of the teacher is to make sure that each student always has materials that are particularly appropriate for him at any given time. In an analysis of developing teacher roles, Wolfson (1968, p. 358) likens this role of the teacher to that of a doctor: "The most popular interpretation of individualized instruction is that the teacher makes specific recommendations and assignments for each pupil. This interpretation rests on the teacher-as-doctor analogy.... That is, she diagnoses needs, deficiencies, or problems and prescribes appropriate treatment." As critical as the design of materials, it is argued that a teacher should specify behavioral objectives (Mager, 1962; Plowman, 1971): these are observable and measureable changes in behavior that he expects in his students as a result of working through a program of study. One such program, called Individually Prescribed Instruction (IPI), is based on the importance of sequencing materials so that students can be required to demonstrate their competence with one set of ideas or skills before they are given new work that is more difficult, (Lindvall and Cox, 1969). These ideas, in general, have even been used to think about making major changes in the organization of the school and the curriculum (Goodlad, 1966), and developments in technology are largely responsible for many new practical possibilities (Gleason, 1967A).

Opportunities for dramatic individualization of instruction are best in schools which

have added learning centers to their traditional structures (Brown, 1968; Hellerich, 1969). The advantage of having learning centers is that a wide range of instructional resources, including materials and equipment, can be offered to students over a large span of grade levels. Whether they are used in addition to or instead of regular classroom work is an issue that needs consideration, but either way, the availability of a learning center in a school greatly facilitates the development of new roles for the teacher.

II.

Impetus for the creation of open classrooms comes from a number of sources. For sometime, there has been an active interest in forming independent study programs (Beggs and Buffie, 1965; Gleason, 1967B). Most schools make some provision for independent learning, and the potential that increased freedom has for enhancing a student's involvement in learning is usually recognized. The drawback of these programs is that they are only available under special conditions, while it is the history of their success that has provided a background of experience on the basis of which to build more general programs. With a more direct focus on the open classroom, theoretical support stems from two lines of argument. From one side, both Neill (1960) and Rogers (1969), in spite of the fact that they have very different views of psychology, argue that it is essential for students to have control over their own learning. Neill argues for the importance of self-regulation and Rogers emphasizes the role of individual meaning, but both would agree that the control is critical for personal growth and the development of the thinking skills that are needed in our culture today. A second argument stems from the application of Piaget's work to education (Furth, 1970; Piaget, 1970). The fact that intellectual growth follows natural stages of development is a logical basis for arguing that a teacher should beware of interfering with critical aspects of the learning process. Practical proposals have been made by teachers who have experimented with these ideas (Kohl, 1969; Holt, 1970), and Featherstone's work (1971) is particularly informative because it is based on observations of English primary schools where the concept of the open classroom has been applied extensively. The strength of these proposals is in their demonstrated practicality; because they are based on experience, their viability has been at least partially tested.

The concept of the open classroom combines an awareness of the significance of individual differences with an interest in changing the focus of present-day educational goals. The chief aims include providing the opportunity for learning how to learn and allowing for the full development of a student's potential. For this reason, paradoxically, the move to create open classrooms is as much contrary to the principles of individualized instruction as it is opposed to the traditional organization of the classroom. The focus of the conflict is in the different goals. Individualized instruction can be dependent for the most part on the use of programed materials because the outcomes of learning are specifically identified. The goals of the open classroom, however, are usually much more general, and the degree of teacher direction that is implicitly given by such materials is inconsistent with these goals.

The two approaches are least incongruent in relation to the use of learning centers.

More precisely, the open classroom can be accurately described as a kind of learning center. The availability of materials and equipment is as important as it is for individualized instruction. Characteristically different, though, from a situation with behavioral objectives, is the nature of the materials that need to be available. In addition to those that would normally be found in a classroom, there need to be many open-ended materials designed to elicit curiosity and raise questions rather than focusing on teaching of specific knowledge and skills. Less teacher direction in the use of facilities is also critical. Instead of specifying objectives, a teacher is expected to help children when they ask for assistance and otherwise allow them to direct their own learning as much as possible. Using another analogy, Wolfson (1968, p. 362) clarifies the role of the teacher in the open classroom by likening him to a travel consultant: "The teacher's role would be primarily that of consultant and resource person to the learner. She would be a manager of the classroom environment, supplying a variety of materials and at times initiating new experiences. She would help pupils learn to plan, to evaluate, and to consider alternatives. She could bring her own interests and inquiry into the classroom. The main focus of her activity would be to promote self-direction." Although the line between the role of the teacher and the student needs to be better understood, Wolfson does show how one can begin to think about teaching in an open classroom in innovative ways.

III.

For designing an educational environment, almost completely anew, on the basis of a theory of student-directed learning, the initial problem is to determine how conflicts between teacher's and students' meaning can be resolved. In the traditional classroom, such conflicts are minimized because the teacher is expected to make all decisions concerning goals, materials, rules, etc. The context is basically the same in a classroom where the major emphasis is placed on individualized instruction. But when a teacher begins to consider the possibility of teacher student planning, as one would within the context of an open classroom, a set of problems different from those traditionally experienced is created. The inclination has been in the operation of open classrooms to solve such problems intuitively. It is feasible, though, to anticipate the kinds of conflicts that are likely to occur and to create a classroom environment which is conducive to their resolution.

A general view of the problem reveals that uncertainty is caused by open-ended environments; this is in contrast to the traditional classroom where the roles of the teacher and the student are relatively well defined. For the teacher, the goals that he has, his ideas about relevant subject matter, and the minimum rules that he thinks students must follow to function within a group have to be open to discussion, challenge, and change. And the student in such a situation has to be willing to articulate what is meaningful for him: his goals, his interests, and his ideas about rules. The resolution of conflict between these two viewpoints depends on the existence of common goals, mutual interests, and agreement about the social conventions that are to be followed. It is reasonable to believe that an educational environment which is designed to help teachers and students reach these kinds of common meaning has to have specific structures within which they can be developed.

What is significantly missing in any uncertain social context is an automatic basis for trust. In terms of template theory, the underlying basis of trust is to withhold the use of the testing mechanisms in the brain that judge the value of one's relationships with others. When a person discovers that he has some important meaning in common with another person, this is the way in which he can enhance the quality of subsequent interaction. Equally important, however, is the need for people to suspend judgment of each other, if only temporarily, in an effort to develop common meaning. The process appears to be cyclical, and out of it, it should be possible to arrive at teacher-student goals, commitments concerning time and work, and an assurance that the methods of evaluation will not be unfair to students (or the teacher) if the commitments are fulfilled. This does not mean that extensive trust can be created instantly, but it is a context within which it can be deliberately built up.

It might be argued that conflicts could easily be minimized if a teacher were willing to help students plan without imposing his own expectations; this is no more tenable, though, than asking students to place complete trust in their teachers and not to bring their personal expectations to the learning process. A more realistic approach to the resolution of conflicts in meaning requires a willingness to modify one's expectations and an interest in finding areas of commonality. It begins with an awareness of the determinants that seem to be given and a sharing of expectations with the purpose of uncovering underlying conflicts. This can be partially accomplished through discussion, but it would seem to be facilitated by activities which are based on temporary commitments. The teacher's role would be to initiate the learning experience within the context of some minimally agreed upon goals. The student would need to not judge the experience while participating in it and he would have to allow himself to become involved. A successful initiating experience might broadly define an area of subject matter, cause positive feelings of tension, and/or provide the opportunity for sensing relevant problems. On the basis of this experience, a teacher and his students could also engage in a dialogue searching for new areas of commonality. The process can be appropriately viewed as initiating teacher-student planning, and it should be generally helpful toward building trusting relationships.

The practical application of initiating experiences to teaching will be hindered mostly by disagreements over the pressure of time. Without agreement on overriding broad goals as to what needs to be accomplished in a given period of time, either the teacher or the student can easily create a failure situation by prolonging unduly any aspects of the initiating process. There is a limit to how much can be communicated in an orientation to students just as an excessively long presentation of a teacher's expectations can make a discussion meaningless. Similarly, students' unwillingness to follow basically the instructions that have been prepared for an initiating experience can delay its completion and deflate the tensions and interest in an inquiry that it was meant to produce. These kinds of problems are not foreign to the teacher in a traditional classroom, but they are much more critical in the context of an open classroom. For one, if there is a commitment to cooperative planning, the authority to keep the process moving is no longer completely in the power of the teacher. Secondly, initiating experiences facilitate only the beginning of an inquiry; if adequate time is not allowed for other phases of inquiry, the total process is undermined.

The success of an initiating experience seems to depend on a teacher's ability to design an activity which is within the range of the students' interests and to obtain a loose agreement concerning what has to be done to complete the activity. How often a teacher might provide such initiating experiences is an open question just as is the determination of its particular nature for any given learning situation. Initiating experiences will probably be quite different for times when one is first meeting a group of students compared to times when one is simply introducing a new subject-matter area. With these questions in mind, though, a practical hypothesis is tenable: that adequate common meaning to serve as a basis for meaningful teacher-student planning can be established through the combination of a short orientation, a sharing of expectations, participation in an initiating experience and a discussion of that experience.

A decision to encourage cooperative planning also creates a number of difficult problems for the teacher. In one way, they are not intrinsically different from those associated with the establishment of common meaning. Planning is basically the creation of a relationship of long-range trust and this means that the two processes are very interdependent. The kinds of activities, however, involved in planning are different and their potential for tangible and immediate consequences is greater. In addition, where the initiation of learning can depend on the usual willingness of people to engage themselves in temporary commitments for a while, the prospect of longer-range commitments tends to make people wary. The most basic problem has to do with closed-mindedness on the part of both the teacher and the students. Such closedness is not unusual for the teacher in the traditional classroom, and it is not automatically dissolved for someone who is trying to create a new educational context. Mainly, it interferes with a teacher's ability to value and build upon a student's past experience and current thinking, and it supports any tendency that students have within the freer context of an open classroom to disregard a teacher's knowledge and experience. The latter is an important part of what the teacher has to offer his students, and the planning process is greatly handicapped without it. This problem, from either side, causes an imbalance in the dialogue that leads to cooperative planning, and it would seem to necessarily impede the process.

Should a productive dialogue actually be established, other problems can come into focus. A teacher and his students may agree on their overall goals and still be in conflict over the specific direction that plans take. Even when their views of relevant subject matter are not in conflict, the evaluation of plans in terms of their probability of success can differ significantly. Of equal importance, a willingness to become involved in a learning activity can be frustrated by a plan which is only capable of generating high initial interest and unable to sustain it for the extended time that the plan might require. The solution of these problems usually falls solely to the judgment of the teacher; structures are needed to create a context within which teacher and students can make them together.

Theoretically, planning learning activities particularly when they are related to the teaching of inquiry skills, is a kind of problem formulation. The unique characteristic of cooperative planning is that common templates are formed in the minds of the teacher and the students. The functional difference between individual and group formulation of plans has to do with the subprocesses that are involved. For the teacher who plans by himself, there is no need to allow system-

atically for every aspect of information processing that is important to problem formulation. With a little awareness, it is possible to coordinate aspects of planning that are related to the subject matter, the learning process, and the likelihood of student interest. In cooperative planning, though, because the processing of information is going on in many minds at once, it is easier to avoid subprocesses and/or to not allow for the increased need for time that is involved in the formation of common templates. One individual should not have responsibility for judging the utility of the process in which the group is engaged.

It is necessary, therefore, that time be allocated for each subprocess that is considered to be critical, and they need to be kept somewhat distinct. First of all, there must be an adequate opportunity for the input of information into the planning process. For the teacher, this means that he has a responsibility to create an awareness of the different ways in which relevant problems can be formulated and the kinds of information, including the range of materials and activities, that can be made available. For the students, this means that there is an opportunity to formulate and reformulate problems sensed in initiating experiences, to raise questions that will facilitate an inquiry into these problems and to propose activities that will be hlepful for resolving them. Secondly, there must be points at which a teacher and his students can negotiate between their two positions. There are an unlimited number of planning problems that might develop, but it is assumed that working agreements can be reached on the basis of a reasonable amount of time spent negotiating. For example, when the formulation of a plan by students requires materials that a teacher is unable to make available, he would ask them to reconsider it. Or, if a teacher judges that a proposed activity is too difficult to undertake, his students might insist that he help them plan a comparable activity that is easier. Thirdly, time needs to be allowed for formalizing plans. Depending on whether students were working individually, in small groups, or as a class, their structure might differ widely, but they would be helpful, in any case, for students and teachers alike. A completed plan for students serves as a detailed guide for a sequence of learning activities, and, for the teacher, such plans direct his preparation and allow for meaningful evaluation.

The application of the theory is easiest if it is actually conceptualized in terms of planning activities. Their order and number might be varied according to differences in subject matter, students, and teachers, but invariably there seems to be a need for the three kinds of activities that have been distinguished. From the input of information, students would gain an overview of the subject matter in a short period of time. From the negotiation, there would result a new level of common meaning--one that is conducive to immediate action. The completed plans of the students and the teachers can almost be considered as an end in themselves. The activities, which logically can be thought of as pre-formulation, negotiation, and post-formulation, constitute structures that are hypothesized to facilitate the planning process. These structures are not likely to be found in a present day school, and their practical development will surely be enhanced by experience and research. Their strangeness, though, might begin to be undone by looking to models outside of education. Cooperative planning is basic to democratic institutions and there could not be a more appropriate model in our society for the design of this aspect of an educational environment.

The design of an educational environment to provide for choice is the least difficult to imagine and implement. Part of the ease is related to the experience of traditional education. Although the overriding goal for most teachers may be the direct transmission of information, it is not always assumed that only a single channel of communication should be used. It is doubtful, indeed, that any challenging classroom environment is devoid of choice. Many teachers are able to make available several channels of communication at the same time, and over the period of a day, a week, or a semester, a child has a fair opportunity to match what he is learning with his interests. This demonstrates how, when a variety of different kinds of relevant information are provided, students' learning of specific knowledge and skills can actually be facilitated. Advances in the development of individualized materials and technology also make problems connected with the provision of choice less of an obstacle than they might appear at first.

For goals of teaching that include the development of inquiry skills, other new developments and changes in emphasis make the offering of appropriate kinds of choice feasible. A context like that of an open classroom is expected to promote learning how to learn and, hopefully, directly help children learn thinking skills. Ordinarily, the kinds of choice that have been offered in schools would not accomplish these goals, but some of the new self-instructional materials are helpfully focused on problem solving and creativity tasks. Another problem, in connection with direct inquiry experience, has to do with the quantity of information that is needed. Much more must be on hand when children are encouraged to engage in high level information processing than would ever be offered in a traditional classroom. The problem is beginning to disappear, however, because of the introduction of a wide range of inexpensive techniques for reproducing information and new means for reducing the amount of space required for storing it. A related problem has to do with the need for open-ended materials. This is more a matter of mental set than one of technology. If one looks to the total body of information that is readily and practically available in our society instead of to that which is usually used in schools, there is no shortage of materials that can be used to raise questions and serve as pools of data necessary for open-ended inquiries.

Toward a radical reconceptualization of the classroom, a general approach to design along these lines is missing only a theory for the organization of choice. All the problems that have been identified are related to students' finding information. This is equally true for learning specific knowledge and skills, for learning general thinking skills, and for engaging in a personal inquiry. The solution is not to create a special organizational structure for each of the different kinds of goals that are involved. The essential element is the opportunity for search activity. What is necessary is an overall structure that facilitates searching for information at as many levels as possible. Thus we return to the idea that the classroom should be designed like a learning center. Two overlapping concepts serve as a basis for accomplishing this kind of reorganization in its most radical form. The first involves recognizing that there are different basic sources of information and it is appropriate for a teacher to use all of them in an effort to make the maximum amount of choice available. The second shows how different kinds of information can be offered at the same time. The clarification of these two concepts, involving sources and kinds of information, illustrates how they might be applied.

It is reasonable to regard experience, observation, and knowledge as the primary bases for obtaining information in place of conceptualizing the teacher as the major source of information for his students. There is nothing unusual about a teacher who is willing to share his own experiences--particularly as they relate to the learning activities of his students. It would be equally helpful, though, for students to have an opportunity to gain their own relevant experience as it relates to their studies, either in the school or in the community. The significance attached to laboratory work and the history of apprenticeships and work-study programs make this idea less foreign than it might initially seem. Similarly, the extensive expansion of the idea of field trips might make systematic observation of any aspect of society or nature an important source of learning. Its general relevance to science is an argument for its value to education. Obviously, the most important source of information in school usually will be knowledge; it is an error, though, to assume that the teacher is its largest storehouse. No person can vie with the amount of knowledge that can be stored and transmitted via recorded communication. Highly innovative educational technology aside, books, programed texts, all other printed instructional materials, and audio-visual aids are so integral to teaching that their unique role can be missed. In addition, a student's previously acquired inowledge and his ability to generate new knowledge through his own thinking can be too easily dismissed. Recorded communication, the student, and the teacher are all valid sources of knowledge upon which to draw.

A look at how different kinds of information can be useful to students reveals a second dimension. Where the student has identifiable questions or skills that he wants, for which established knowledge exists, it would be foolish to look elsewhere for such information. To do otherwise is what makes "discovery learning" a phony process. Similarly, during the planning of an inquiry, it is relevant to directly learn strategies that are equivalent to broad thinking skills and information that are necessary for initiating experiences. They may need to be restructured in terms of a student's personal information processing style, but they clearly are the simplest means for facilitating an inquiry. Yet a third kind of information is needed to create pools of data toward which the search phase of an inquiry can be directed. This would be an unusual kind of material to find in a classroom because it can include relatively disconnected information which only acquires meaning to the extent that it becomes a part of a student's search activity. These categories are not mutually exclusive; there is a need to plan for each of them separately, though, if they are all to be included in an educational environment.

In general, if care is taken to muster as many opportunities for experience, observation, and gaining knowledge as possible, and a broad view is taken concerning the kinds of information that are relevant, a teacher will have an excellent basis for providing a wide variety of choice. The teacher's minimal role would be to make available a sufficient range of sources and kinds of information to allow for plans that have been negotiated. With the accumulation of materials and experience, though, it is easy to imagine a classroom environment which would actually begin to stimulate searching for information. Sometimes a teacher would be called upon, as a resource within that environment, to transmit knowledge directly; the teacher's main role, though, in relation to search activity, would be to continue developing the design of the environment and to keep it organized.

SUMMARY

An attempt has been made to show how there is a range of possible ways to design an innovative educational environment. Relatively close to the context of traditional education, it is possible to create a classroom setting in which most instruction is individualized. Secondly, it is possible to organize an open classroom by simply reducing the directive role of the teacher. Not only is instruction highly individualized, but there is also a great deal of freedom for students with regard to goals, subject matter, movement within the classroom, etc. The third alternative is to develop a structured open classroom by designing an environment on the basis of a theory of student-directed learning. From this vantage, new kinds of structures would be introduced with the specific aim to facilitate the establishment of common meaning between a teacher and his students, to encourage the cooperative planning of learning activities, and to make as much choice of materials and activities available to students as possible. A teacher's task is to determine the learning environment that would be personally supportive of the kind of role that is most consistent with his conception of teaching.

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